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GADD (C. H.) & LOOS (C. A.). **The basidiospores of Exobasidium vexans.**—*Trans. Brit. mycol. Soc.*, xxxi, 3–4, pp. 229–233, 1 fig., 1948.

A study of *Exobasidium vexans* causing blister blight of tea in Ceylon supported Sawada's view that the two-celled spores [*R.A.M.*, xxvii, p. 389] borne on the convex under surface of the blistered area are bicellular basidiospores [ibid., i, p. 454]. Very few non-septate spores were found apart from those attached to basidia, the smaller non-septate spores undoubtedly being an earlier stage of the larger ones. The larger non-septate spores had a range of 6 to 14 by 2·8 to 4·3 μ, which, with their shape, indicates that they were the basidiospores, not yet mature, of Tunstall and Bose (*Quart. J. Indian Tea Ass.*, ii, pp. 209–213, 1921). The freshly gathered material subjected to minimum disturbance bore uniseptate spores, measuring 14 to 17 by 3·5 to 5·6 μ, still attached to the sterigmata, while numerous similar spores lying free on the surface of the blister and unquestionably those previously regarded as the conidia of Massee (*Kew Bull., 1898*, pp. 109–111) are considered to be mature basidiospores; they ranged from 13 to 27 by 4·3 to 6·5 μ with a mean (for 50 spores) of 18·7 by 5·5 μ. The facility with which septate basidiospores are dislodged provides a simple explanation of their abundance on the hymenial surface and their rarity on the basidia.

In Massee's figures the spores are shown as thick-walled. The two-celled basidiospores, so abundant on young blisters, as observed by the authors were thin-walled, but in older material numerous free spores with thick walls, similar to those shown by Massee, and also basidia and hypha were found. It appears that ageing or a change in climatic conditions may induce wall thickening. The size and shape of the thick-walled spores, together with the fact that none was found on a conidiophore, left no doubt that they were basidiospores. They suggest resting spores, but whether the thickening of the wall increases viability and enables the spore to survive during unfavourable weather conditions has not yet been ascertained, but the fact appears to be worth consideration.

The two-celled basidiospores germinated readily in hanging drops of water, germ-tubes emerging terminally or laterally in about five hours. In empty, germinated spores, two or even three septa were sometimes clearly visible, though before germination only one had been apparent. Evidently the additional septa were formed during germination, otherwise the flow of protoplasm from the centre into the germ-tubes would have been prevented. Spores which produced lateral germ-tubes always had an additional septum, probably present before germination, as the only way by which the protoplasm could move from a middle compartment would be by a lateral germ-tube. No haustoria were seen in hanging drops or on leaf surfaces. Entry into the leaf, therefore, probably occurs through the stomata, though such entry was not observed by the writers.

KOSTOFF (D.). **The reactions of parental Tobacco plants and of their hybrids to 'female sterility virus'.**—*Arch. ges. Virusforsch.*, iii, 2, pp. 57–61, 1943.

An account is given of observations and experiments at the Central Agricultural

Research Institute, Sofia, Bulgaria, on hybrids between *Nicotiana glauca*, which is tolerant of the female sterility [tomato big bud] virus [*R.A.M.*, xii, p. 600; xv, p. 754], and tobacco, *N. rustica*, and the amphidiploids, *N. rustica* × *N. glauca* and *N. suaveolens* × *N. glauca*. The symptoms developing in the progeny of the crosses, infected either by grafting with diseased material or cultivation in proximity to tobacco harbouring the virus, tended to be relatively mild in the *glauca*-like segregates and more severe in those of the susceptible *rustica* type. The symptoms were also rather mild in plants having two genoms of *N. glauca* and one of *N. rustica*. These results suggest that the tolerance of *N. glauca* towards the tomato big bud virus tends to recession in respect of symptom expression.

The tolerance of *N. glauca* cannot be ascribed to its anabasine content, a dominant character which is likewise present in the hybrids showing big bud virus symptoms, as well as in the tobacco and *N. rustica* scions used for grafting.

Beach (W. S.). **Zerlate followed by fixed copper spray controls Tomato disease without injury.**—*Rep. Pa agric. Exp. Sta. 1946–7* (*Bull.* 488), *Suppl.* 3, pp. 5–6, 3 figs., 1948.

In July and August, 1947, experiments were conducted at the Pennsylvania State College farm to determine the relative injury caused by Bordeaux mixture (6–3–100), tribasic copper sulphate (4–100), and zerlate (2–100) to Valiant, Stokesdale, Garden State, and Rutgers tomato plants. Five applications of each fungicide were made at ten-day intervals. An attack of early blight [*Alternaria solani*: *R.A.M.*, xxvii, pp. 164, 174] was followed by a severe outbreak of late blight [*Phytophthora infestans*: ibid., xxvii, p. 435]. The results indicated that there was definite injury by Bordeaux mixture. The first three varieties thus treated yielded over 4 tons less than those treated with tribasic copper sulphate. The late-maturing Rutgers showed a decrease of 0·9 tons. The average number of fruits on Bordeaux-sprayed plants was about three-quarters of that on those treated with tribasic copper sulphate. Since *P. infestans* destroyed many young fruits and blossoms, it could not be ascertained whether tribasic copper sulphate and zerlate were injurious. Zerlate alone is not very effective against late blight, but three zerlate sprays followed by two of tribasic copper sulphate gave the highest fruit number and weight for Rutgers (50 fruits per plant and 15 tons per acre). In the control of *Alternaria* blight there were no decided differences among the fungicides tested.

Garden State showed high resistance to late blight. The disease-loss for untreated plants was only 13·6 per cent., compared with 23·7, 39, and 59 per cent. for Valiant, Stokesdale, and Rutgers, respectively.

Krenner (J. A.). **Studien aus dem Gebiete der mikroskopischen Pilze. II. Die Cylindrosporiose der Edelkastanie. Der Ursprung der Pilze.** [Studies in the field of microscopic fungi. II. Cylindrosporiosis of the Sweet Chestnut. The origin of the fungi.]—*Bot. Közl.*, xli, 3–5, pp. 115–141, 1 pl., 1944. [Hungarian summary.]

In the summer of 1934 sweet chestnut trees at Elekpuszta, near Mozsgó, Hungary, were severely affected by a fungal disease, resulting in premature defoliation. The infected leaves were spirally twisted and bore numerous, sometimes coalescent, dark-brown, pinhead-sized spots, surrounded by a paler brown area. On the under side of the leaves, there were also minute black spots (pycnidia). The disease occurs in many European countries and in North America.

The author identified the fungus as *Cylindrosporium castaneae* (Lév.) n. comb., based on *Septoria castaneae* Lév. (1846), which antedates *S. castaneicola* Desm. (1847) (*C. castanicola* (Desm.) Berl.) [*R.A.M.*, xxvi, p. 204]. The author considers that the connexion between the conidial form and *Mycosphaerella maculiformis* [ibid., xviii, p. 355, xx, p. 558] remains unconfirmed.

The colourless, cylindrical, irregularly bent, 2- to 4-septate spores measure 39 to 58 by 2·3 to 3·3 μ. After sporulation, a striking change takes place in the fruiting body, which becomes like that of the Sphaeropsidales. The original hyaline, plectenchymatous layer becomes black, the shape alters, and the pycnidium formed in the cavity finally produces minute pycnidiospores, which do not germinate. The fungus is parasitic only in its Melanconiaceous condition, later it is saprophytic. The metamorphosis accounts for the confusion and mistakes in the classification of the fungus.

GREMMEN (J.). **Het voorkomen van peritheciën bij Microsphaera quercina (Schwein.) Burrill.** [The occurrence of perithecia in *Microsphaera quercina* (Schwein.) Burrill.]—*Ned. Boschb. Tijdschr.*, xx, 9, pp. 272–273, 2 figs., 1948. [English summary.]

During the abnormally hot and dry weather of August and September, 1947, the perithecia of oak mildew (*Microsphaera quercina*) [*M. alphitoides*], which usually occurs in Holland only in the imperfect state, developed in abundance and produced fully ripe ascospores [cf. *R.A.M.*, xix, p. 49; xxvii, p. 395]. The same phenomenon was observed in a number of other Erysiphaceae, including *Phyllactinia suffulta*, the agent of powdery mildew of beech and other hardwoods [ibid., xxvi, p. 317].

WRIGHT (E.) & WELLS (H. R.). **Tests on the adaptability of trees and shrubs to shelterbelt planting on certain Phymatotrichum omnivorum root rot infested soils of Oklahoma and Texas.**—*J. For.*, xlvi, 4, pp. 256–262, 2 figs., 1948.

One limitation to the establishment of shelterbelts or windbreaks in certain districts of Oklahoma and Texas is the natural occurrence of root rot (*Phymatotrichum omnivorum*) in the soil. Experiments covering a six-year period showed that none of the trees or shrubs tested for this purpose was immune, but a high degree of resistance was exhibited by hackberry (*Celtis occidentalis*), western soapberry (*Sapindus drummondii*), desert willow (*Chilopsis linearis*), eastern red cedar (*Juniperus virginiana*), and Rocky Mountain juniper (*J. scopulorum*), with total percentages killed from 1937 to 1942 of 1·4, 0·3, 0·1, 0·1, and 0·1, respectively [cf. *R.A.M.*, xix, p. 403]. On the basis of these trials tentative suggestions are made for the composition of five-row windbreaks on root-rot-infested soils.

Forest research in India and Burma 1945–46. Part I. The Forest Research Institute.—161 pp., [? 1947].

On pp. 51 and 77 of this report [cf. *R.A.M.*, xxi, p. 399] D. NARAYANAMURTI gives the results of toxicity tests with several varieties of creosote and creosote fractions at concentrations of 2, 3, 4, and 5 per cent. using sal (*Shorea robusta*) sapwood blocks and *Polystictus sanguineus* as the test fungus. The toxic limits in lb. per cu. ft. for creosotes C, D, E, and F were 0·6–0·83, 0·54–0·7, 0·65–0·79, and less than 0·24, respectively. *S. robusta* sleepers treated with creosote and ascu and laid in 1940 on the Bombay, Baroda, & Central India Railway near Muttra were found to be in a satisfactory condition when examined in October, 1945. Creosoted *Terminalia arjuna* sleepers laid near Kalyan were also found to have given satisfactory service when inspected in September, 1945.

Toxicity and accelerated service tests were carried out using 5, 7·5, 10, and 15 per cent. B.O.C. oil on *S. robusta* test blocks and using *P. sanguineus* as the test fungus. A 20 per cent. loss in weight was obtained even with blocks having an adsorption of 2 lb. per cu. ft.

ROTH (L. F.), TOOLE (E. R.), & HEPTING (G. H.). **Nutritional aspects of the littleleaf disease of Pine.**—*J. For.*, xlvi, 8, pp. 578–587, 1 fig., 1948.

Little leaf disease of pine, which primarily affects shortleaf (*Pinus echinata*) and

to a lesser extent loblolly (*P. taeda*), is a serious and widespread deterioration of unknown etiology. Diseased shortleaf pines show a marked deficiency of nitrogen and calcium in the foliage. A number of fertilizers and other soil amendments have been tested in Alabama [*R.A.M.*, xxvii, p. 51] for their effect in the prevention or amelioration of the condition, and foliage treatments were given in North Carolina. The addition of nitrate or ammoniacal nitrogen at rates exceeding 200 lb. available nitrogen per acre prevented the onset of little leaf to a remarkable extent in repeated experiments, and either arrested the disease or materially improved the status of trees already affected. At the concentrations used, salts or combinations of salts of 14 other elements, applied in various ways, and organic matter added as leaf mould, stable manure, or compost, have exerted little or no beneficial effect. Little leaf appears to be associated with failure of the trees to absorb sufficient nitrogen, even where soil nitrogen is present in amounts regarded as adequate for the development of normal shortleaf pine.

Boggess (W. R.) & Stahelin (R.). **The incidence of fusiform rust in Slash Pine plantations receiving cultural treatments.**—*J. For.*, xlvi, 9, pp. 683–685, 1948.

Cultural treatments have resulted in a marked increase of fusiform rust (*Cronartium fusiforme*) cankers in slash pine [*Pinus caribaea*: *R.A.M.*, xxvii, p. 398] plantations established in 1938 at Auburn, Alabama. The treatments, which included intercropping with cotton and complete fertilizer amendments, resulted in the production of $1\frac{1}{2}$ times more volume than in uncultivated plantations, but at the same time the incidence of infection was four times as high in the former as in the latter. About 90 per cent. of the cankers were either situated on the stems or were entering them from infected limbs.

Tree breeding at the Institute of Forest Genetics.—*Misc. Publ. U.S. Dep. Agric.* 659, 14 pp., 11 figs., 1948.

An account is given of the history, organization, and functions of the Institute of Forest Genetics, a field laboratory of the Forest Service, United States Department of Agriculture, operated by the California Forest and Range Experiment Station. One of the projects comprised in the hybridization programme is the development of a timber tree of good form and resistant to blister rust [*Cronartium ribicola*] by crossing the Balkan pine (*Pinus peuce*), which is of poor form but highly resistant to the disease [*R.A.M.*, xvi, p. 357], with eastern white pine [*P. strobus*]. Hybrids between these two species are reported to have shown great promise in this respect in the Royal Botanical Gardens of Denmark, and experiments with the pollen of these hybrids and of *P. peuce* are now in progress in California.

Scheffer (T. C.) & Duncan (Catherine G.). **The decay resistance of certain Central American and Ecuadorian woods.**—Reprinted from *Trop. Woods*, *1947*, 92, 24 pp., 2 graphs, 1947.

The authors tabulate and discuss the results of tests to determine the resistance of 41 species of wood from Costa Rica, Panama, and Ecuador to eight wood-rotting fungi, viz., *Lenzites trabea*, *Poria microspora*, *P. incrassata*, two strains of *P.* spp., *Stereum frustulosum*, *Polyporus* [*Polystictus*] *versicolor*, and *Polyporus gilvus*. The experiments were performed on small stakes in soil and with pure cultures on blocks in the laboratory.

The heartwood of 14 species proved sufficiently resistant to infection to warrant classification as very durable. They were (in descending order of resistance) *Erythoxylum glaucum*, *Tabebuia chrysantha*, *Libidibia* [*Caesalpinia*] *corymbosa*, *Minquartia guianensis*, *Platymiscium pinnatum*, *Myroxylon balsamum*, *Vitex gigantea*, *Chlorophora tinctoria*, *Persea* sp., *Pseudotsuga taxifolia*, *Cryptocarya* sp.,

Robinia pseud-acacia, *Cordia alliodora*, and *Clarisia racemosa*. The 13 durable species included two oaks (*Quercus copeyensis* and *Q. alba*) and *Cedrela fissilis*. Radial variability in decay resistance within individual trees was fairly marked in 16 species, half of which showed a trend from higher resistance in the outer to lower in the centre heartwood. The sapwood of nine species was classified as durable on the basis of these tests, viz., *Humiria* sp., *Sickingia* sp., *Persea* sp., *T. chrysantha*, *V. gigantea*, *Minquartia guianensis*, *L. corymbosa*, and *Cryptocarya* sp.

A report has already been published by Alma M. Waterman (*Trop. Woods, 1946*, 88, pp. 1–11, 1946) on the amount of the hot water-soluble extractives in the outer heartwood of 11 of the tropical species and their toxicity to malt agar cultures of *L. trabea* and *Poria microspora*. Although the interspecific differences in these respects were considerable, they did not furnish reliable evidence of resistance to decay as judged by the reputations of the several species. In view of the fact that, in the case of *R. pseud-acacia*, the hot water extractives were found to account for much of the variation in decay resistance [to *Fomes rimosus*: *R.A.M.*, xxiii, p. 418], the conflicting results of the later tests suggest that these substances are not the sole sources of fungus inhibition, or else that the experimental procedure did not fully bring out their typical antagonistic properties.

Bavendamm (W.). **Die Prüfung der natürlichen Dauerhaftigkeit des Holzes, insbesondere des Tropenholzes, gegen Pilze, Termiten und Bohrmuscheln.** [The testing of the natural resistance of wood, especially tropical wood, to fungi, termites, and marine borers.]—*Z. Weltforstw.*, xii, 7–9, pp. 137–144, 1948. [English and French summaries.]

Included in the author's critical survey of the literature on testing the natural durability of wood, especially that of tropical origin, are a number of papers on laboratory and field methods of determining its resistance to fungi, some of which have been noticed in this *Review*. A bibliography of 113 titles is appended.

Hubert (E. E.). **Non-pressure preservative treatment of poles with pentachlorophenol in the Northwestern States.**—*Proc. Amer. Wood Pres. Ass.*, xliii, pp. 126–139, 5 figs., 1947.

In the north-western area of the United States standard A[merican] W[ood] P[reservers] A[ssociation] pressure treatment full length with creosote is specified for Douglas fir [*Pseudotsuga taxifolia*], southern yellow pine [*Pinus palustris*], and lodgepole pine [*P. contorta* var. *latifolia*], while the standard butt treatment with creosote is specified for the [western red] cedar [*Thuja plicata*]. Under the war standard specifications, Douglas fir, lodgepole pine, jack pine [*P. banksiana*], and western larch [*Larix occidentalis*] may be given a full-length non-pressure treatment with hot and cold creosote, or with hot creosote followed by a cold bath of 5 per cent. pentachlorophenol in petroleum with 15 per cent. creosote added. The same treatment may be used for western red cedar, while full-length, non-pressure treatment with a pentachlorophenol solution, followed by standard butt treatment with creosote, is specified for the same species used in semi-arid regions and for northern white cedar [*T. occidentalis*] for general use. Most of the lodgepole and larch poles are treated by means of the hot-and-cold bath process, and during the creosote shortage the main preservative used was a 5 per cent. solution of pentachlorophenol with or without creosote.

Solutions containing 5 per cent. by weight of pentachlorophenol in suitable petroleum oils are being marketed in ready-to-use or concentrated (10 : 1) form, that used in most of the new pole-treating plants being lauxtol A, manufactured by the Western Division of Monsanto Chemical Company, Seattle. A list of cheap oils suitable as diluents for lauxtol A is given.

The combination of Shell dehydrating oil no. 27 for the hot bath and Shell dieseline with 5 per cent. pentachlorophenol for the cold gave excellent penetration (0·6 to 1·5 in.) in the incised sapwood of yard-seasoned lodgepole pine poles butt-treated with a schedule of four hours at 225° F. and four hours at 110°. Green and partly air-seasoned poles require a longer hot-bath schedule of from 8 to 14 hours, and with these the results are not so good.

It is concluded that proper treatment of well-processed, seasoned poles with pentachlorophenol preservatives should give clean, inexpensive products showing deep penetration and adequate absorption and possessing a high degree of permanency in resisting decay in service.

WALKER (J. C.). **Vegetable seed treatment.**—*Bot. Rev.*, xiv, 9, pp. 588–601, 1948.

The author describes the recognized methods of seed treatment [*R.A.M.*, xxvii, p. 53; xxviii, p. 44] by disinfestation, disinfection, and protection, and indicates the major trends in and current recommendations for vegetable seed treatment. Future research should deal with the interaction between the materials, host, pathogen, and environment, with the improvement of commercial materials and methods of treatment, and the development of assay techniques whereby the principal pathogens may be detected with certainty. A bibliography of 70 references is appended.

WARREN (J. R.). **An undescribed species of Papulospora parasitic on Rhizoctonia solani Kühn.**—*Mycologia*, xl, 4, pp. 391–401, 3 figs., 1948.

In experiments to determine the cause of black root disease of sugar beets in Ohio, 7·6 per cent. of the 690 isolations made from diseased seedlings yielded *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xxvii, p. 344] in association with species of soil fungi. Of these, an undescribed species of *Papulospora* was isolated from 4·3 per cent. of the total number of isolates, and in some cases was the only fungus obtained from apparently diseased seedlings.

In pathogenicity tests all six isolates of *C. solani* tested caused symptoms of the black root disease varying in severity while six of *Papulospora* produced no characteristic symptoms. The fact that some of the *C. solani* isolates were much more virulent in pot tests than in the field suggested that under natural conditions there might be some antagonism. Observations showed that an actual parasitism of *C. solani* by the *Papulospora* occurred. In Petri dish cultures the *Papulospora* mycelium overgrew and entwined that of *C. solani*. In slide cultures and on slides left in infested soil the *Papulospora* produced lateral branches which coiled round the hyphae of *C. solani* and penetrated them in several cases.

The parasite *P. stoveri* n.sp. is described as having profuse, light buff mycelium with surface hyphae measuring 5·7 μ in diameter, and much branched, irregularly septate, submerged hyphae, 6·7 μ in diameter. It produces bulbils which are burnt sienna in colour when young and reddish brown at maturity and range in size from 480 by 384 to 640 by 544 (average 630 by 488) μ.

Pots of soil containing ten-day-old cultures of four isolates of *C. solani* were mixed with ten-day-old cultures of *P. stoveri*. Four days later two pots from each series were sown each with 25 beet seed pieces and the remaining pots 20 days later. All the pots were resown 55 days after the mixing took place. The numbers of seedlings surviving ten days after planting in soil containing *C. solani* strain H–10 plus *P. stoveri* were 14, 8·5, and 20·4, in the three sowings, respectively, while the corresponding survival numbers in soil containing only *C. solani* were 7·5, 9·5, and 11·2, respectively. The control of the three other strains of *C. solani* was less marked. The results indicated that in pot tests *P. stoveri* was effective in reducing the amount of black root caused by some but not all strains of *C. solani* and that its efficiency increased as the interaction time was increased.

Grente (J.). **Les maladies de la Betterave.** [Beet diseases.]—*Cah. Inst. tech. franç. Betterave industr.*, 3, 35 pp., 8 col. pl., [? 1948].

In this well-illustrated publication a brief introduction in popular terms is given to the different types of symptom, the causal agents and their development, the general methods of control of the parasitic diseases of beets, and the general characters of the physiological disorders. Then follow the symptoms, development, cause, economic importance, and control of each disease, a key for the identification of which is provided [cf. *R.A.M.*, xviii, p. 287].

Bean seed certification.—*Agric. Gaz. N.S.W.*, lix, 11, p. 599, 1948.

The bean [*Phaseolus vulgaris*] seed certification scheme [cf. *R.A.M.*, xxvii, p. 591] was continued for the fifth successive season during 1947–8 when 762 acres (148 crops) were inspected and 365 acres (68 crops) were passed for certification. About 65 per cent. of the certified seed consisted of Brown Beauty, 33 per cent. Hawkesbury Wonder, and 2 per cent. Tweed Wonder, Wellington Wonder, and Clarendon Wonder. Most of the available seed of Canadian Wonder and Startler Wax is carrying halo blight [*Pseudomonas medicaginis* var. *phaseolicola*] or anthracnose [*Colletotrichum lindemuthianum*] or both.

Andrus (C. F.). **A method of testing Beans for resistance to bacterial blights.**—*Phytopathology*, xxxviii, 9, pp. 757–759, 1 fig., 1948.

A new technique, known as 'multiple needle, primary leaf inoculation', has been used since 1942 in trials of snap beans (*Phaseolus vulgaris*) for resistance to common and halo blights (*Xanthomonas phaseoli* and *Pseudomonas medicaginis* var. *phaseolicola*) at the U.S. Regional Vegetable Breeding Laboratory, where a breeding programme for the development of resistant garden types has been in progress since 1938. The multiple needle inoculator consists of 90 No. 0 insect mounting pins with their head ends embedded in the end of a cylindrical block of sealing-wax. The primary leaf is placed on a rubber or cellulose sponge saturated with bacterial suspension, and two strokes are used in passing the inoculator through the leaf into the sponge. The first forces the leaf into close contact with the sponge, the second draws in additional inoculum. The plants are grown in pots and inoculated on about the 14th day, or when the first trifoliate leaf is beginning to open. Readings are made 12 to 14 days later, based on the amount of tissue breakdown extending from the inoculated area. All terminal and axillary growth is pruned away to ensure a more uniform development of the primary leaves.

The two main advantages of the method are the absence of escapes and the provision of a reaction area that can be measured quantitatively. Furthermore, it has emphasized two important environmental influences on the host reaction to these blights, namely, (1) at temperatures above 80° F. all varieties tend to appear susceptible, and (2) abnormally weak plants or those attacked by root rots (*Rhizoctonia* or *Fusarium*) are apt to show enhanced susceptibility.

McCallan (S. E. A.). **Evaluation of chemicals as seed protectants by greenhouse tests with Peas and other seeds.**—*Contr. Boyce Thompson Inst.*, xv, 2, pp. 91–117, 4 figs., 6 graphs, 1948.

There is a need for simple, rapid screening methods to differentiate the few promising fungicidal materials deserving of more elaborate tests, from the numerous untried chemicals. Accordingly, quantitative studies were made, over a three-year period, of various factors influencing the preliminary evaluation in greenhouse tests of chemicals as possible seed protectants. Perfection peas, highly susceptible to seed decay and damping-off due predominantly to a species of *Pythium* [*R.A.M.*, xxviii, p. 44], were used.

The seeds, mainly in units of 100, were treated by being revolved mechanically in 2 oz. specimen bottles with the various experimental dusts as well as with semesan, arasan, yellow cuprocide, and spergon, at one or more dosages from the series 4, 1, 0·25, 0·0625, and 0·0156 per cent. of seed weight. They were planted in flats of naturally infested soil, the basic unit being a replicated row of 10 seeds for each dosage. The controls consisted of untreated seed sown in steam-sterilized and in infested soil to check the inoculum potentials.

Treatments did not differ in their effectiveness in controlling post-emergence (as distinct from pre-emergence) damping-off, expressed on the basis of number of seeds planted rather than on the number emerging, indicating that damping-off is probably independent of treatment. Stand, therefore, may be estimated on percentage emergence after 14 days, and there is little to be gained by recording height. Increasing the depth of planting delayed, but did not change, final emergence.

After use, infested soil is composted and diluted with fresh greenhouse soil to be used again. There is little change in the inoculum potential up to a dilution of 1 in 4. Emergence increases and inoculum potential decreases with the logarithm of the soil dilution.

Most chemicals appear to give a straight-line response when plotted on a logarithmic-probability scale. The slopes are flat but vary for different compounds. Arasan was the most effective material, followed by spergon and semesan, yellow cuprocide being the least effective. Cream-coloured peas are twice as susceptible to decay as the intermediate coloured ones and four times as susceptible as green peas. A table of significant differences, compiled from cumulative errors of the two components, treatment × test interaction and replicate 10-seed row, shows that a difference of 27 per cent. is necessary for significance with two treatments tested once with three replicated rows, and an 11 per cent. difference for three tests and 10 replicates.

In limited tests with other vegetable seeds, radishes proved sensitive to copper injury and lima beans [*Phaseolus lunatus*] especially so to mercury. Most seeds were either too small or too large for use in an ideal test.

A series of tests using 157 chromate complexes was made to exemplify this procedure. Following a first test on peas at a dosage of 0·0625 per cent. on 30 seeds, 18 materials were run in a second test also on peas at three dosages in comparison with semesan and yellow cuprocide. Six of these were selected for trial on beet, bush bean [*P. vulgaris*], cucumber, lima bean, radish, and spinach, and as a result No. 224 ($7ZnO . 2HgO . 2CrO_3 . 7H_2O$) and No. 640 ($ZnO . 4CuO . CrO_3 . XH_2O$), which compared favourably with the standard fungicides, are considered to be worthy of field trials.

Atkinson (J. D.). **Cracked-stem of Celery (Apium graveolens L.)**—*N.Z. J. Sci. Tech.*, A, xxix, 5, pp. 261–264, 2 figs., 1948.

Cracked stem of celery has been present in the Auckland district of New Zealand since 1924. From 1942 to 1945 the growth of the crop was greatly extended to supply troops in the Pacific theatre of war, and the quality requirements of this export trade were higher than those of the local market. In consequence, a considerable quantity of celery was rejected on account of cracked stem, and in some crops the disease was a major problem. The symptoms closely resemble those described from Florida [*R.A.M.*, xvi, p. 792], except for certain differences in the root and leaf symptoms. In New Zealand the root systems of diseased plants are light brown, and scattered sparsely over the larger roots are small, orange-coloured patches of tissue that flake away readily. The knob-like appendages on the roots and brownish foliar mottling reported from Florida have not been observed in New Zealand.

Soil dressings of borax applied on 14th November, 1946, reduced the incidence

of cracked stem (mean for six plots) from 87·3 to 1·3 (at 40 lb. per acre) and 0·8 per cent. (at 20 lb.). All the sticks from one of the plots treated at the higher rate were first grade, while in an adjacent untreated plot 41 per cent. were first grade, 35 per cent. second, and 24 per cent. valueless.

HEUBERGER (J. W.). **Controlling downy mildew on Cucumbers for pickles.**—*Food Packer*, xxix, 7, pp. 60, 62, 1 fig., 1948.

The results of two years of research (1946 and 1947) at the Delaware Agricultural Experiment Station on the use of three zinc dithiocarbamate fungicides, zerlate, parzate, and dithane Z–78, showed that these materials, when properly formulated, are non-injurious to cucumbers, equally effective with copper-containing preparations in control of downy mildew [*Pseudoperonospora cubensis*], and productive of high yields [*R.A.M.*, xxvii, p. 7]. To cite some data from the tables, the yield increases (in percentages) in 1946 were as follows: Bordeaux mixture 6–3–100, 36·3, compound A 3–$\frac{1}{3}$–100, 22·6, fermate 2–100, 35·4, zerlate 2–100, 48·2, parzate 2–100, 28·6, dithane Z–78 2–100, 49·7, and dithane D 14 plus zinc sulphate—lime 1$\frac{1}{2}$–1–$\frac{1}{2}$–100, 12·3, the corresponding figures for 1947 being 30·7, 30·9, 29·9, 53·7, 81, 70·9, and 48·3, respectively. It was further estimated that the yields were increased as follows by the treatments before the appearance of downy mildew: in 1946, Bordeaux 7·3 per cent., fermate 25·2, zerlate 25·9, parzate 6·4, and dithane Z–48 27·1; and in 1947, by 10·4, 8·1, 25·9, 57, and 31·1 per cent., respectively, with the addition of dithane D 14 plus zinc sulphate—lime, 20·7.

CAPOOR (S. P.) & VARMA (P. M.). **A mosaic disease of Lagenaria vulgaris Ser. in the Bombay Province.**—*Curr. Sci.*, xvii, 9, pp. 274–275, 1 fig., 1948.

In August, 1939, *Lagenaria vulgaris* plants at the Agricultural College Farm, Poona, were affected by a hitherto undescribed virus disease, which was found to be prevalent in the Bombay Province, causing substantial damage to the crop. The first symptoms, appearing 10 to 14 days after sap inoculation of healthy seedlings, are well-marked, intermingled pale and dark green patches, which gradually become diffuse as the leaves grow in size and age. Occasionally bright yellow or whitish, chlorotic areas develop at random on the leaf blade. The leaves are much stunted and the vines thin, dwarfed, and weak. Fruits set on diseased plants are usually small and weigh less than those of healthy ones and often show severe, patchy discoloration.

The virus is readily transmissible by the sap, but only two out of 824 plants raised in an insect-proof glasshouse from commercial seed were found to harbour it. It withstands ten minutes' heating at 95° C. but not at 98° and retains its infectivity at a dilution of 1 in 1,000,000 and in storage for 308 days in the laboratory. It further resists 24 hours' treatment with 95 per cent. ethyl alcohol and remains viable on desiccation. The *L. vulgaris* virus readily infects its own host, cucumber, melon, watermelon, *Citrullus* [*vulgaris* var.] *fistulosus*, *Luffa acutangula*, and *Trichosanthes anguina*, while vegetable marrow and *Momordica balsamina* contract the disease in a symptomless form and thus act as carriers. Other cucurbits and a number of plants belonging to unrelated families reacted negatively to infection by the virus.

The virus disease under discussion is quite distinct from the *Lagenaria vulgaris* mosaic described by Vasudeva and Lal [*R.A.M.*, xxiii, p. 126]. On the other hand, it closely resembles Ainsworth's cucumber green-mottle mosaic virus [ibid., xiv, p. 554] in its host range (restricted to Cucurbitaceae) and physical properties, though differing in its capacity for multiplication in vegetable marrow, which could not be infected by the cucumber virus. It is proposed, therefore, to group the authors' *L. vulgaris* mosaic virus with *Cucumis* virus 2 [cucumber green-mottle mosaic] as *Cucumis* virus 2 B, according to K. M. Smith's classification [ibid., xvii,

p. 53], and *Marmor astrictum* var. *lagenari* n. var. in Holmes's scheme [ibid., xix, p. 229].

Hildebrand (A. A.). **Soybean diseases in Ontario.**—*Soybean Dig.*, viii, 10, pp. 16–17, 2 figs., 1948.

Because of generally unsuitable climatic conditions in other parts of Canada, commercial soy-bean production is practically restricted to Ontario, where the area under the crop rose from 10,000 acres in 1940 to 59,200 in 1946. Each year since 1941 an intensive disease survey has been made, and 14 of the roughly 30 maladies known to affect the soy-bean have been found in the province [*R.A.M.*, xxvi, p. 280]. Of these eight, or perhaps nine, are seed-borne. The virus diseases are represented by mosaic [ibid., xxvii, p. 7] and bud blight [tobacco ring spot virus: see next abstract], while those of fungal origin include downy mildew [*Peronospora manshurica*], pod and stem blight [*Diaporthe phaseolorum* var. *sojae*: ibid., xxiii, p. 3; xxvii, p. 55], *Fusarium* blight or wilt [ibid., xxiv, pp. 264, 356], *Sclerotinia* stem rot [*S. sclerotiorum*: ibid., xxvi, p. 280], and the newly discovered brown stem rot [*Cephalosporium* sp., see next abstracts].

In 1942 the incidence of mosaic reached epidemic proportions, with up to 50 per cent. infection in some stands. Pod and stem blight was also severe in that year, and both diseases were regarded as limiting factors in soy-bean production. Neither disease, however, has since recurred in an equally serious form. In 1943 *Fusarium* blight was the most prominent disease, while 1944 was marked by the first appearance of bud blight and charcoal rot [*Macrophomina phaseoli*: ibid., xvii, p. 7]. *Fusarium* blight is definitely on the increase in Ontario, and in 1947 a commercial stand had to be abandoned for the first time on account of its prevalence. In 1945 and 1946 downy mildew was exceptionally widespread, and infection was found to be largely disseminated by systemically diseased plants, i.e., those grown from contaminated seed. In June or July the mycelium develops on the under surface of the leaves and soon produces an abundance of spores; these are rapidly conveyed by wind, rain, &c., to neighbouring healthy plants, resulting in local epidemics, which tend to become general under favourable weather conditions. *S. sclerotiorum* was detected for the first time on 11th September, 1946, on a small group of Lincoln soy-beans in the corner of a 12-acre field protected on two sides by a dense wind-break. By the 27th the pathogen had almost completely destroyed three to four acres of the stand. In many cases the fungus had spread from the stem into the pods, where the seeds had been replaced by sclerotia. The disease did not reappear in 1947 [cf. ibid., xxvii, p. 403].

Seed treatment trials have been conducted each year since 1943 with spergon, arasan, fermate, and phygon (the last-named in 1946 and 1947 only) [ibid., xxvi, p. 280]. Treatment of seed encrusted with downy mildew with spergon [loc. cit.] resulted in increased yield in 1947.

Chamberlain (D. W.). **Soybean disease investigations in 1947.**—*Soybean Dig.*, viii, 10, p. 18, 1948.

The season of 1947 presented many reversals in the scale of relative importance of soy-bean diseases in the Middle West. For instance, brown stem rot (*Cephalosporium* sp.) [*R.A.M.*, xxvii, p. 213] and bud blight (tobacco ring spot virus) [ibid., xxvii, p. 7], two of the leading diseases in Illinois during the last three years, caused relatively little damage in 1947, whereas the once-insignificant leaf spot due to *Septoria glycines* [ibid., xxvi, p. 281] has become the most destructive of its class in Illinois, especially where rotation is neglected. In 1943 and 1944 bacterial pustule (*Xanthomonas phaseoli* var. *sojense*) was the most prevalent soy-bean disease, bacterial blight (*Pseudomonas glycinea*) [*P. glycines*: ibid., xxvii, p. 7] being of minor importance, whereas in 1947 the positions were reversed. Wildfire (*P.*

tabacum) [loc. cit.], which was fairly well established in Illinois a few years ago, was not observed in 1947.

Two fungal diseases were unusually widespread in the State in 1947, viz., *Rhizoctonia* root and basal stem rot [*Corticium solani*: ibid., xxii, p. 463] and *Alternaria* leaf spot [ibid., xxiii, p. 332]. The former occurred during the cool, wet weather in early summer, killing the young plants in scattered areas up to several feet in diameter. It disappeared with the advent of hot, dry conditions, when its place was taken by the comparatively unimportant leaf spot, the dark-brown, zonate lesions developing in profusion on plants approaching maturity.

An intensive search for disease-resistant soy-bean material is in progress within the framework of the plant-breeding programme [ibid., xxvii, p. 212]. Of some 1,100 introductions and varieties tested for resistance to bacterial blight in 1947 at Urbana, Illinois, 50 showed relatively little infection, and three apparently highly resistant selections from this group were singled out as promising.

In 1947 the conspicuous foliar symptoms of brown stem rot failed to develop, but weekly observations throughout the growing season in Illinois revealed its presence in the roots and basal stems, and by the end of July the internal browning had progressed a few inches up the stem. During August the mean temperatures seldom fell below 75° F. and were often above 80°, with the result that the fungus made little headway [see next abstract].

Rotation only control for stem rot.—*Soybean Dig.*, viii, 10, p. 18, 1948.

First observed in Illinois, brown stem rot [*Cephalosporium* sp.: see preceding abstracts] has become increasingly important in that State, as well as in Indiana, Iowa, Missouri, and Ohio. Severely infected fields present a frosty appearance due to the white coating of the fungus. Brown stem rot is soil-borne and can be combated by a quadrennial system of crop rotation, dying out in three years in the absence of its host. It is held in check by hot weather, being suppressed by temperatures above 80° F., but causes heavy damage with a drop to between 60° and 70° in the late summer and early autumn. Apart from the little-grown mung bean [*Phaseolus aureus*], brown stem rot has only been found to attack soy-beans.

Liu (S. T.). **Seed-borne diseases of Soy-bean.**—*Bot. Bull. Acad. sinica*, II, 2, pp. 69–80, 1948.

Field and laboratory studies on seed-borne diseases of soy-beans carried out in China during 1945–7 showed that pod and stem blight (*Diaporthe phaseolorum* var. *sojae*) [*R.A.M.*, xxvii, pp. 7, 55] causes serious damage in Chengtu and Nanking, especially when the pods are attacked in the rainy season. Stems, pods, seeds, and petioles and sometimes the leaves are attacked, infection often starting where branches have been injured by insects, wind, or weight of pods. The fungus is sometimes accompanied by the fruiting bodies of other organisms, especially those of *Glomerella glycines* [ibid., xxvii, p. 7], which are scattered, whereas those of *D. phaseolorum* var. *sojae* are usually in rows. In 1947, isolates from 420 diseased seeds of the early Yellow Seed variety from the market of Tanyang, Kiangsu, comprised *D. phaseolorum* var. *sojae* 35·48 per cent., *G. glycines* 16·9 per cent., *Cercospora kikuchii* [ibid., xxvii, p. 404] 12·62 per cent., *Fusarium* spp. 7·86 per cent., *Penicillium* spp. 7·14 per cent., *Aspergillus* spp. 5·95 per cent., bacteria 3·35 per cent., *Choanephora* sp. 1·67 per cent., *Alternaria atrans* [ibid., xix, p. 256] 0·95 per cent., and *Phyllosticta* [*Pleosphaerulina*] *sojaecola* [ibid., xxvii, p. 460] 0·24 per cent. The occurrence of purple speck (*Cercospora kikuchii*) on the seed has long been observed in China and Japan.

Leaf spot is due to *C. vignicola* [ibid., xi, p. 149; xvi, p. 493] which is also common on cowpea. In 1945, Olive *et al.* described a fungus from soy-bean and cowpea as *Helminthosporium vignae* [ibid., xxv, p. 150; xxvii, p. 10]. The author isolated

these organisms from cowpea leaves and soy-bean seeds. From their descriptions they appear to be the same and there was no difference in cultural characters between them. Olive placed the fungus in *Helminthosporium* because of the catenulate conidia and the presence of vesicles on conidia in culture. The author believes that these characters may be influenced by environmental factors. Vesicles on conidia are not a constant structure, and catenulate conidia are produced only in very moist conditions. The fungus is an intermediate type between the two genera, but most of the conidial characters indicate that it is nearer to *Cercospora*, and it seems advisable to refer the fungus to *C. vignicola* with *H. vignae* as a synonym.

Anthracnose caused by *G. glycines* [ibid., xix, p. 512] is very serious on the pods in wet weather near harvest time. Perithecia were obtained in cultures from diseased pods and stems, but their morphology did not agree well with that of *G. glycines*, so that the identity of the ascigerous state observed by the writer and its connexion with the conidial state are uncertain.

Another form of pod anthracnose is caused by a species of *Gloeosporium* which produces circular, later sunken spots with a distinct, army brown margin. The pink, asetose acervuli develop well. The hyaline, straight, rarely slightly curved, non-septate, oblong conidia, often with granular reflective bodies when formed on the pods, measure 11·2 to 16·8 by 4·2 to 5·6μ. Inoculations caused the development of spots on the seeds and cotyledons.

The leaf spot organism, *P. sojaecola* [ibid., xviii, p. 292; xxiv, p. 5], was found on the seeds of Yellow Seed soy-beans in Chengtu and Nanking. It was not observed on pods in the field. The leaf spot was important in the field near Nanking in 1945 and 1947, and is probably widely distributed in China.

A. atrans was commonly isolated from diseased seeds, and leaf infection by this fungus was observed in the field near Nanking. In artificial inoculations by the author the fungus was able to infect healthy tissues only through needle punctures [cf. ibid., ii, p. 250].

A widespread and highly destructive attack of pod blight (*Macrophoma mame*) occurred in Chengtu and Nanking. The fungus, first described by K. Hara (Pathologia Agriculturalis Plantarum, 1932) attacks only the pods and seeds, but the damage is sometimes very extensive. In years when rain falls frequently from August to October, infection becomes epiphytotic, resulting in considerable pod deformation in September and October. The affected pods bear water-soaked lesions showing a little white mycelium; these rapidly enlarge and turn dull greenish-black. The lesion is usually depressed and in wet weather bears abundant white aerial hyphae which soon cover the whole pod, turn dark greenish-olive, and are eventually transformed into a black crust bearing black globose dots. When seeds were artificially inoculated, infection began as an irregular, water-soaked, natal brown lesion which rapidly enlarged; the seed-coat was cracked, and the lesion usually depressed and wrinkled. The black, globose to subglobose, sometimes papillate, ostiolate pycnidia were 131·6 to 180·2 μ in diameter. The clavate, hyaline, simple, continuous conidiophores were 7 to 14 by 3 to 4·5 μ and the non-septate, hyaline, fusiform to narrowly oblong conidia were 15 to 24·8 by 6·5 to 8·1 μ on the host and 11·9 to 21·1 by 4 to 7·6 μ in culture.

A *Diplodia*, not corresponding to any species known to the writer, was isolated from diseased Yellow Seed seeds collected in Chengtu in 1945. In September, 1947, a severe outbreak of blight, called *Diplodia* black dot, on developing pods was noted in Wusih and Changchow on fully grown plants. This fungus is parasitic chiefly on the pods, infection arresting seed development. In serious cases it may involve the whole plant. Growth was very rapid, the fungus soon covering the pod, which turned pale smoke grey or light buff. The black, pyriform or globose, slightly immersed pycnidia were 290 to 392 μ high and 232 to 290 μ in diameter.

The brown to olive, oblong, uniseptate spores, slightly constricted at the septum, averaged 22·4 by 13·3 μ. Inoculations on the leaves, hypocotyls, and cotyledons caused tawny or brown, sometimes sunken spots.

Mycosphaerella sojae was encountered only in isolations from diseased seeds collected in Chengtu and Nanking. Inoculations affected only the cotyledons, causing brown spots. *Rhizoctonia* [*Corticium*] *solani* [ibid., xxii, p. 463] was isolated from discoloured seeds, but the disease has not been recorded in the field in China. From diseased seeds collected in Nanking a typical *Helminthosporium* was isolated, but it was not encountered in the field, though inoculation tests on seedlings showed the fungus to be pathogenic to the foliage. The fungus appears to be as yet undescribed. The conidiophores are usually simple, erect, sometimes geniculate above, bistre to brownish-olive, becoming paler (sometimes almost hyaline) towards the tip, and measuring 181·5 to 227·7 by 5·3 to 6·3 μ. The attachment scars are somewhat conspicuous. The oblong to obclavate, mostly straight or curved, 3- to 9-septate, buffy brown to olive-brown conidia arise successively at intervals and measure 30 to 100·1 by 10·9 to 16·8 μ.

Bavendamm (W.). **Wie unterscheide ich die Speisepilze von den Gift- und Bitterpilzen?** [How do I distinguish edible from poisonous and bitter fungi?]—*Merkbl. Reichsinst. Forst- und Holzw.* 7, 59 pp., 30 figs., 1948.

A key is given for the identification of 120 species of fungi belonging to 40 genera in ten families, with directions for the differentiation of the edible from the poisonous and bitter kinds and notes on the culinary uses of the edible ones.

Le court-noué dans le vignoble portugais. [Court-noué in Portuguese vineyards.]—*Bull. Off. int. Vin*, xxi, 205, pp. 16–17, 1948.

Court-noué has been observed in Portuguese vineyards, especially in the districts of Santarem, Dois Portos, and Canas de Senhorim. Among the varieties affected are Vital, Fernão Pires, Baja de Loiro, and Arinto de Douro. Side by side with the vines suffering from court-noué were others infected by the mosaic virus, and studies are in progress at the National Agronomic Station to determine whether one and the same entity is responsible for both diseases.

Luttrell (E. S.). **Physiologic specialization in Guignardia bidwellii, cause of black rot of Vitis and Parthenocissus species.**—*Phytopathology*, xxxviii, 9, pp. 716–723, 1 fig., 1948.

During the past three years black rot, attributed to *Guignardia bidwellii* [*R.A.M.*, xxviii, p. 53], has been observed on Virginia creeper (*Parthenocissus quinquefolia*) and Boston ivy (*P. tricuspidata*) in several parts of Georgia. Attention was drawn to the disease by the rejection for certification of a local nurseryman's muscadine grape stock on account of the proximity to his vineyard of infected Virginia creeper. In the light of previous studies on muscadine black rot [ibid., xxvi, p. 143], it seemed improbable that the fungus on Virginia creeper would serve as a source of infection for muscadine grapes, and the investigations herein described were concerned primarily with this problem.

The results of cross-inoculation experiments with pycnidiospore suspensions of the fungus from *P. tricuspidata*, *P. quinquefolia*, the muscadine grape (*Vitis rotundifolia*), and a native bunch grape (*V. labrusca*) on the same hosts, on another indigenous bunch grape (*V. bourquina*), and on the European bunch grape (*V. vinifera*) showed that *G. bidwellii* comprises three physiologic races differing in pathogenicity and to a lesser extent in morphological and cultural characters. The inoculum from either Virginia creeper or Boston ivy infected both these hosts but no species of grape. Conversely, no infection of the two *P.* spp. was obtained with inoculum from either kind of grape. The muscadine and bunch grape strains

attacked only their own hosts, but the European grape proved susceptible to infection from both sources. Virginia creeper and Boston ivy, therefore, are unlikely to harbour the form of *G. bidwellii* pathogenic to grapes.

The three races are classified as follows: *G. bidwellii* f. *euvitis* n.f., parasitic on American species of bunch grape and *V. vinifera*; *G. bidwellii* f. *muscadinii* on *V. rotundifolia* and *V. vinifera* [loc. cit.]; and *G. bidwellii* f. *parthenocissi* n.f. on *P.* spp. Whereas the muscadine grape race differs from the other two in mean ascospore width, the mean ascospore lengths for the three races form an intergrading series. The differences between the three races in pycnidiospore dimensions are even slighter than those in ascospore size. In the type of colony produced in culture on 3 per cent. malt agar, *G. bidwellii* f. *parthenocissi* is intermediate between the other two races, producing a black mycelium with the pycnidia densely grouped on the surface, the growth being much more extensive than that of the muscadine grape race and forming a flat, widespread subiculum over the medium. *G. bidwellii* f. *euvitis* produces a white, rapidly growing mycelium which turns grey or black with age, the pycnidia being scattered over the agar. The black mycelium of *G. bidwellii* f. *muscadinii* forms a hemispherical stromatic mass with densely aggregated pycnidia.

Du Plessis (S. J.). **Registration of Vine nurseries.**—*Fmg S. Afr.*, xxiii, 270, pp. 591–595, 2 figs., 1948.

In this paper, indicating the registration facilities offered to vine growers in South Africa by the Department of Agriculture to ensure the production of healthy nursery vines, it is stated that vineyards and nurseries are carefully examined by inspectors during the year of registration to detect any infection by bacterial blight [*Erwinia vitivora*: *R.A.M.*, xxvii, p. 173] and consignments from those certified as disease-free are entitled to bear a certification tag.

Plantesygdomme i Danmark 1946. Aarsoversigt samlet ved Statens plantepatologiske Forsøg. [Plant diseases in Denmark 1946. Annual survey of data collected by the State Phytopathological Experiment Station.]—*Tidsskr. Planteavl*, lii, 2, pp. 237–292, 2 graphs, 1948. [English summary.]

The following are among the many items of interest in the sections contributed to this report by H. R. Hansen and Anna Weber [cf. *R.A.M.*, xxvii, p. 410]. Manganese deficiency was reported from various districts to be severe and sometimes general in the winter cereal crops. The application of manganese (50 kg. per ha.) to the soil caused scorching of barley foliage. The same trouble occurred sporadically in beet fields and was also unusually prevalent in potatoes. Barley sustained heavy and widespread damage from potash deficiency, which was also prevalent and destructive among potatoes, entire fields presenting the appearance of a late blight (*Phytophthora infestans*) epidemic and withering by the beginning of August. Barley loose smut (*Ustilago nuda*) was much more severe and general than in 1945, the Rigel, Freja, and Maja varieties being the most susceptible, while Archer was little affected and the reactions of Kenya and Binder were intermediate. Numerous reports of ergot (*Claviceps purpurea*) in rye were received from Jutland, where four to six sclerotia were commonly found in every ear. Barley was also attacked in several localities, and there were a few cases of infection in timothy [*Phleum pratense*] grown for seed.

Potato late blight was severe and widely distributed, several primary outbreaks being reported at the end of June and beginning of July. Yield increases ranging from 400 to 5,400 kg. per ha. were obtained in 13 experiments by spraying with 2 per cent. Bordeaux mixture. Wart disease (*Synchytrium endobioticum*) was notified from 15 new municipalities. Black leg (*Bacillus phytophthorus*) [*Erwinia phytophthora*] was exceptionally widespread, especially in the Bintje and Imperator

varieties, and led to the rejection of 96 out of 1,353 ha. of seed potatoes offered for certification.

The season of 1946 was marked by calamitous epidemics of apple scab (*Venturia inaequalis*). The unparalleled severity of the disease was promoted by the heavy rains which largely precluded timely spraying. Serious damage also resulted from *V. pirina*, but pears are more tolerant of Bordeaux mixture than apples, and this most effective anti-scab preparation can therefore be more freely applied. Of late years cherries (especially the sour varieties) have sustained increasingly heavy damage from scab (*V. cerasi*). They are sensitive to copper injury after flowering, when Bordeaux mixture and similar compounds should be replaced by colloidal sulphur or other preparations. The wet weather during the strawberry ripening period contributed to heavy infection by grey mould (*Botrytis cinerea*), especially on Deutsch Evern.

The humid conditions also favoured the occurrence of other *B.* spp. on ornamentals, e.g., *B. elliptica* on lilies, *B. paeoniae* on peonies, and *B. tulipae* on tulips. *Dahlia* mosaic virus was widespread, and great care should be taken, particularly in propagating houses, to discard all plants with the faintest symptoms of the disease. In one Jutland garden every *Dahlia* plant was attacked by crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*). Rose black spot (*Diplocarpon rosae*) assumed a destructive character, many bushes being defoliated early in the season. Like the other scab pathogens, *V. chlorospora* was favoured by the wet summer and caused serious damage on willows [*Salix*: ibid., xvi, p. 590] in various places.

Gudrun Johansen contributes a note on the occurrence of *Alternaria grossulariae* Jacz. [ibid., iv, p. 227] on gooseberries, a new record for Denmark. The dark brown conidia measured 31 to 67 by 8·5 to 14·5 μ and were formed in short chains. Positive results were obtained in inoculation tests on wounded unripe fruits.

Neergaard (P.). **11–12. Aarsberetning fra J. E. Ohlsens Enkes plantepatologiske Laboratorium. 1 August 1945–31 Juli 1947.** [Eleventh annual report from the J. E. Ohlsen phytopathological laboratory. 1st August, 1945, to 31st July, 1947.]—19 pp., 1948. [English and Esperanto summaries.]

From 1st August, 1945 to 31st July, 1946, 4,594 samples of various horticultural seeds were tested, and 6,181 during the same period of 1946–7. Carrot seeds commonly harboured *Stemphylium radicinum* [*R.A.M.*, xxv, pp. 383, 582; xxvi, p. 405], which occurred in 57 out of 157 lots in the former, and in 80 out of 202 in the latter year, and *Fusarium avenaceum* (14 and 18, respectively).

Tables are given showing the prevalence of *Alternaria brassicicola*, *A. brassicae*, *A. raphani* [loc. cit.], and *Phoma lingam* on various crucifers during the two years under review. Cauliflower, kale, white, red, and Savoy cabbage, Brussels sprouts, kohlrabi, and radishes were more or less heavily contaminated by *A. brassicicola* in both seasons. *A. brassicae* occurred in 27 out of 106 lots of radish in 1945–6 and in 94 out of 136 in 1946–7, the corresponding figures for *A. raphani* being 48 and 90, respectively. *P. lingam* was encountered in a few lots of cauliflower, white, red, and Savoy cabbage, kohlrabi, and radish. All three species of *Alternaria* were found in samples of *Matthiola incana*, while *Iberis umbellata* yielded *A. brassicicola* and *A. brassicae*.

Septoria petroselini was found in 19 out of 39 lots of parsley [ibid., xxiv, p. 158; xxvi, p. 69] in 1945–6 and in 15 out of 43 in 1946–7. In the former year it also occurred in nine out of 35 lots of celeriac, and in the latter in five out of eight of celery and 16 out of 23 of celeriac. *S. apii* was present in nine out of 39 lots of celery in 1945–6 and in 21 out of 31 in 1946–7. Parsley was further infected in 1945–6 by *Stemphylium radicinum* var. *petroselini* [ibid., xxv, p. 383] (11 out of 39 lots).

Three out of 12 lots of chives were contaminated by *Botrytis byssoidea* [ibid., xxv, p. 90] in 1945–6, and the same fungus occurred in one out of 109 lots of onions in 1946–7. Two out of five lots of spinach yielded *Rhizoctonia* [*Corticium*] *solani* [ibid., xxiv, p. 470] in 1945–6.

B. cinerea was detected in many samples of flower seeds, including aster (38 out of 131 lots in 1945–6, 100 out of 268 in 1946–7), *Clarkia elegans* (49 out of 75 and 74 out of 81, respectively), *Godetia hybrida* (32 out of 65 and 58 out of 80) [ibid., xxv, p. 383], *Primula obconica* (30 out of 41 in 1946–7), *Antirrhinum majus*, *Calendula officinalis*, *Freesia hybrida*, *Helichrysum bracteatum*, *Sinningia hybrida*, and *Tagetes erecta*.

Alternaria cheiranthi was found in 16 out of 33 lots of wallflower seed [ibid., xxv, p. 582] in 1945–6 and in 17 out of 30 in 1946–7; an apparently new *A.* sp. in *Chrysanthemum carinatum* (15 out of 54 and 23 out of 46, respectively); *A. dianthicola* on carnation [ibid., xxv, p. 580] (34 out of 83 and 43 out of 132), *A. gypsophilae* on *Gypsophila elegans* (two out of seven and 13 out of 23) and *G. paniculata* (two out of three in 1945–6) [ibid., xxv, p. 582]; *A. linicola* on *Linum grandiflorum* [ibid., xxvi, p. 405] (17 out of 19 in 1945–6 and two out of 14 in 1946–7); *A. resedae* on *Reseda odorata* [ibid., xxv, p. 580] (17 out of 20 in 1945–6); and *A. zinniae* [ibid., xxv, pp. 203, 383, 581] on *Zinnia elegans* (nine out of 33 in 1945–6 and 45 out of 87 in 1946–7), in one of the above-mentioned lots of *R. odorata*, in one out of 46 of *Centaurea cyanus* (1946–7), and in one out of eight of *Gerbera jamesonii* (1946–7), the last three being presumably new hosts. One out of four lots of *Calendula officinalis* (1946–7) contained *A. porri* [ibid., xxv, p. 581].

Report of the Division of Mycology.—*Sci. Rep. agric. Res. Inst. New Delhi, 1946–7*, pp. 109–117, 1947. [Received November, 1948.]

Of the 41 wheat varieties tested during the period under review [cf. *R.A.M.*, xxviii, p. 114] for their reactions to isolate L1 of loose smut (*Ustilago tritici*), 24 did not contract infection, while 12 developed up to, and five more than, 10 per cent. Dr. Hanna, of the Dominion Laboratory of Plant Pathology, Manitoba, Canada, examined six Indian collections of the smut and believes them to represent at least three physiologic races distinct from the four known in Canada. Nos. L1, L2, and L3 appear to belong to one race, L4 to a second, and L5 and L9 to a third.

In two out of three isolates of Karnal wheat bunt (*Neovossia indica*) sporulation decreased markedly in successive subcultures, but the third continued to sporulate profusely in the repeated transfers. Numerous inoculation experiments with *N. indica* on wheat gave uniformly negative results.

In inoculation tests with *Fusarium udum* on pigeon pea (*Cajanus cajan*), the percentage of infection on the I.P. 69 and N.E. varieties was much lighter (93·2 and 73·2, respectively) in sterilized than in unsterilized soil (40 and 46·6, respectively).

The following fungi were isolated from diseased *Cicer arietinum* plants collected in the vicinity of New Delhi: *F.* spp., *Rhizoctonia bataticola* [*Macrophomina phaseoli*], and *Operculella padwickii* [ibid., xxvi, p. 144]; in addition to these, specimens from Karnal harboured *Sclerotium rolfsii*. Plants jointly inoculated with *F. orthoceras*, *M. phaseoli*, *S. rolfsii*, and *O. padwickii* showed typical field symptoms; wilt developed in those inoculated with *F. orthoceras* alone, while the sclerotial fungi caused chlorosis of the lower leaves and shedding of the leaflets, which gradually extended upwards, the bare leaf stalk remaining yellow and stiff. Inoculation with *O. padwickii* alone also resulted in chlorosis of the lower leaves; later the leaflets turned brown and folded upwards, while in some cases they dropped and the leaf stalk curved upwards.

Potato late blight (*Phytophthora infestans*) was first observed at Kufri (Simla Hills) about mid-July, 1946. Of 103 hybrids and selections tested for their reactions to the disease, 22 failed to take the infection and 74 gave a positive response. The

species isolated from diseased tubers in the same locality in 1945 and 1946 was definitely established to be new to science and has been named in a forthcoming publication *P. himalayensis* Dastur. The species found at Simla and lower altitudes causing a potato leaf rot is believed to be identical with *P. parasitica*.

The results of preliminary experiments indicate that *Solanum* virus 1 [potato virus X] is transmissible by dust storms, rain, and leaf contact. The seed potato multiplication scheme was reorganized on account of the unsatisfactory results obtained from crops raised at Karnal. The entire lot of 'seed' required for 1946–7 was purchased from fields of the Phulwa variety at Hapur (United Provinces) with a low incidence of disease (about 4 per cent.).

In connexion with studies on a number of virus diseases of economically important crops, the *Crotalaria juncea* and *C. striata* mosaic viruses and tomato bronzing were found to be transmissible by sap inoculation, and the eggplant mosaic virus and tomato top necrosis by grafting. The crystals of which the *C. juncea* virus is composed were shown to be glassy, acicular, and very thin.

A pale, abundantly sporulating type of *Colletotrichum falcatum* [*Physalospora tucumanensis*] predominated in the numerous isolations from infected sugar-cane in parts of the United Provinces where red rot occurred in epidemic form. The varieties chiefly affected were Co. 312 and the local 'Mamchuah', which is apt to be mistaken for Co. 370. Among the most resistant of the 83 leading parent cane varieties used in inoculation tests with *P. tucumanensis* were Co. 356, 419, 421, and 453. Of 36 isolates of the fungus from different canes and localities tested on ten varieties with very variable reactions to red rot, the one from Co. 312 and Mamchuah in areas where the epidemic was rife proved to be highly virulent. Ratoon and plant-crop canes of ten varieties were simultaneously inoculated with the pale type of *P. tucumanensis* (isolate No. 78) at Karnal. In all varieties the ratoons sustained considerably heavier damage than the plant canes, and comparable results were obtained in experiments with the dark type (isolate No. 3). The pathogen lost its viability in the compost pit in two to three months and in soil within the latter period.

The above-mentioned 83 cane varieties were also tested for their response to smut (*Ustilago scitaminea*) [ibid., xxviii, p. 5]. None of the important commercial varieties showed any resistance. *Saccharum spontaneum* procured from Coimbatore was found to be highly susceptible to smut, but the same species from Java did not contract the disease.

The teleutospores of lentil rust (*Uromyces fabae*) germinate freely without a resting period at 12° to 18° C., but no germination occurred at temperatures below 7° or above 26°. Cultures of *Ricinus communis* rust (*Melampsorella ricini*) [ibid., xix, p. 330] could not be maintained on the host plants beyond the beginning of April owing to the rise in temperature. The uredospores of *Puccinia carthami* from safflower [ibid., xxvii, p. 541] germinate between 12° and 26° and the teleutospores between 12° and 18° (without a resting period). A culture of the rust on its host could be maintained only up to mid-May on account of the increasing heat, and the same applies to the rust of *Cicer arietinum* (*U. ciceris-arietini*).

Steemson (B. T.). **Report on the Department of Agriculture, Gold Coast, for the year 1947–8.**—14 pp., 1948.

In this report [cf. *R.A.M.*, xxvii, p. 508] it is stated that in the Gold Coast, as a result of an intensive survey of 1,173,609 acres of land containing 460,700 acres (39·3 per cent.) of cacao to ascertain the distribution and extent of swollen shoot [ibid., xxvii, p. 557; xxviii, p. 120], 2,515,354 affected trees have been cut out on initial treatment and 378,729 on re-treatment. Totals for the year were 179,005 acres of cacao surveyed, 1,296,705 diseased trees cut out on initial treatment, and

324,059 on re-treatment. About 46 million diseased trees are estimated to remain, of which 45 millions are in the Eastern Province.

At the end of March [1948] control measures had come almost to a standstill and the disease situation was deteriorating. Treated districts adjoining the area of mass infection were becoming reinfected, swollen shoot was again spreading in areas of scattered outbreaks previously brought under control, and in the replanted devastated area young trees, some already in bearing, were becoming infected from the few diseased trees left.

As a result of the passing of a motion by Legislative Council, 18th September, 1947, questioning the desirability of pursuing the policy of cutting out infected trees, a Committee of Enquiry was appointed [see below, p. 163]. It reported that with one or two unimportant modifications the existing legislation met the requirements of the situation. The Government has announced that it proposes to launch a 'rehabilitation grants to cacao farmers scheme', at an estimated cost of £3,000,000. It allows for payment of an initial grant of £5 for every acre of cacao lost, and £7 more for every acre replanted.

A coco-nut wilt in the Keta-Ada area, which has been known for some time, caused the death of many trees. Investigations suggested that the trouble might have been aggravated by a succession of dry seasons which had lowered the water table, but that the general unhealthiness was due to poor soil.

Lime production in the Cape Coast district continues to decline. In spite of satisfactory weather, purchases in 1947 were about 8 per cent. lower than in 1946, which was a poor crop year. A six-monthly survey of a sample 10 per cent. of farms showed that trees of all ages were still dying. Investigations strongly suggest that the primary cause is a virus; all limes on their own roots are dying out at such a rate that in seven or eight years the export of limes may cease. The only hope appears to lie in replacing seedling by budded plants. The Department therefore embarked upon a programme to produce 100,000 limes budded on rough lemon stocks as soon as possible, and to sell these to farmers at a nominal price. By the end of the year there were in stock at nurseries throughout the area 15,000 budded plants ready for distribution, over 70,000 rough lemon plants ready for budding, and 200,000 younger rough lemon plants. Enough nursery space had been cleared to take the whole 100,000, plus an allowance for budding failures.

Plant pest and disease calendar.—*Leafl. Dep. Agric. Cyprus* 22, 8 pp., 1948.

A list is given of the commoner pests and diseases of cultivated crops in Cyprus, arranged under each month of the year, with brief directions for their control. A special vine disease and pest control schedule is appended.

Phillis (E.). **Trinidad and Tobago Administration Report of the Director of Agriculture for the year 1947.**—19 pp., 1948.

This report [cf. *R.A.M.*, xxvii, p. 222] contains the following items of phytopathological interest. The propagation of cacao clones resistant to witches' broom [*Marasmius perniciosus*: loc. cit.] is proceeding rapidly; the majority of the production (approximately 2,500 plants per month) is being used for the establishment of new nurseries. In Tobago the disease is slowly spreading, and a vigorous campaign to check it has been initiated. The results of the survey of the cacao virus disease [loc. cit.] show that the disease is confined to the north-western part of the island. The rate of lateral spread appears to be very slow (mainly by contact), but occasional jumps of over a mile have been observed. All plants at the main Cacao Propagating Station, which is surrounded by a cacao-free belt of 1½ miles in radius, were carefully watched and no case of virus disease was reported.

Mosaic disease of sugar-cane occurred on a localized site covering three or four acres, the outbreak being due to infected planting material from a small area. The

'pocket' has been eradicated, and Trinidad can be counted as free from the disease. One estate in Trinidad reported a small outbreak of 'pokkah boeng' disease [*Gibberella fujikuroi*: ibid., xxvii, pp. 44, 256], which has not previously occurred in the country. All diseased plants were destroyed.

Investigations into the dying-out of limes indicated that the trouble is not restricted to any particular set of conditions nor is it due to any pathogen. It is a condition peculiar to limes and on sour orange stocks they may die back completely to the graft union, while the stock remains healthy. Shade, which reduces crops considerably, may delay, but does not prevent the condition.

D'Angremond (A.). **Verslag van den Directeur van het Algemeen Proefstation der A.V.R.O.S. over het tijdvak 1 Januari 1940–31 December 1940.** [Report of the Director of the General Experiment Station of the A.V.R.O.S. for the period 1st January, 1940, to 31st December, 1940.]—*Meded. alg. Proefst. Avros*, Alg. Ser., 60, 59 pp., 1948.

The following items of phytopathological interest occur in the botanical section of this report (pp. 13–38) [cf. *R.A.M.*, xxi, p. 323]. Inoculations were performed on tobacco at the Deli Experiment Station, Sumatra, with bacteria from the vessels of dying *Aleurites* plants presenting slime disease symptoms. After a fortnight the tobacco plants exhibited a similar appearance, but did not succumb to the infection. Hence it is concluded that the *Aleurites* pathogen was, in fact, *Pseudomonas* [*Xanthomonas*] *solanacearum*, but a milder strain than that commonly affecting tobacco.

Gambier [*Uncaria gambier*] plants were attacked by white root rot (*Rigidoporus microporus*) [*Fomes lignosus*: ibid., xxvii, p. 540], which also remains the most important parasite of *Hevea* rubber, especially in young clearings. In an experiment with a 1½-year-old planting on cleared land, after two years the percentages of mortality and severe disease on the section where the stumps of the old trees had been left in the ground were 22·8 and 9·5, respectively. Half-yearly treatments of the infected roots with 2 per cent. copper sulphate (later replaced by Bordeaux mixture), with eradication of the old roots and stumps, resulted in 16·4 per cent. mortality and 7·4 per cent. severe disease, while the same treatments, combined with reasonably thorough removal of the debris, reduced these figures to 3·1 and 0·4, respectively.

Black root rot (*Rosellinia bunodes*) killed young rubber trees in another clearing, where the interplanted *Tephrosia* was also attacked by the same fungus and the agent of brown root rot (*F. noxius*). *Albizzia moluccana* and *A. sumatrana* suffered from a die-back associated with *Botryodiplodia theobromae*.

A single instance of infection by the white fan fungus (*Collybia* sp. or *Marasmius palmivorus*) was recorded, and there were a few cases of die-back both in young and old plantings. Two stem rots of oil palm were observed, namely, the common one due to *F. noxius* and another, mostly restricted to the base, caused by *Ustulina zonata*.

Tea sustained local damage from red root rot (*Ganoderma pseudoferreum*).

Berkeley (G. H.), Carter (W.), & van Slogteren (E.). **Report of the Commission of Enquiry into the swollen shoot disease of Cacao in the Gold Coast.**—10 pp., London: H.M. Stationery Office (Colonial, No. 236), 1948. 3*d*.

As a result of their enquiry into the incidence and nature of swollen shoot disease of cacao in the Gold Coast [see above, p. 161], carried out from October to December, 1948, the Commissioners note in their report that the rate of spread is very slow among trees up to three or four years old, but is much more rapid among older trees when their leaf canopies are in contact with one another. Moreover, the older the tree the more likely it is to be infested with ants and mealybugs; a severely

infested tree may harbour up to 3,000 mealybugs, most of which are spread throughout the canopy and are covered by connecting earth shelters constructed by the ants.

It is recommended that thorough and continuous cutting out of diseased trees should be resumed as promptly as possible and on a greatly increased scale. The identification of infected contact trees may be simplified by coppicing them and thus hastening the appearance of symptoms. Owing to the difficulty of destroying large-sized forest trees known to be reservoirs of the virus, destruction should be limited, at present, to those found on infected farms. As long as the staff is insufficient to cover the entire cacao-growing area, cutting out should be concentrated in areas of lesser infection. Immediate action on a large scale is imperative to check effectively the headway gained by the disease.

Once all sources of infection have been removed, rehabilitation may be attempted by replanting in lightly infected areas combined with resurvey and retreatment. Replanting in areas of high initial infection is considered inadvisable until all diseased trees have been completely removed since many of the apparently healthy trees which remain after treatment will undoubtedly be infected, and new 'raging belts' would be established as soon as new seedlings were large enough to permit the rapid spread of the virus. The danger of small infected farms is emphasized, for, if left untreated, they will serve as foci of infection for surrounding farms.

Planting in straight lines to facilitate inspection and treatment and the use of seed of better and earlier maturing varieties are recommended to assist in control and rehabilitation. Every possible method should be used to speed up the reproduction of the small quantity of improved cacao selections now available at the West Africa Cacao Research Institute. It is believed that the progress of the disease could be considerably reduced by using DDT to protect young cacao trees against the initial inroads of mealybugs and ants.

The research programme should be concerned primarily with efficient methods for the destruction of trees by means of chemicals since this method has shown promising results in other countries. Current immunization studies should be intensified on an experimental scale. The development of resistant varieties should be maintained as a long-term project and an effort made to increase the Institute's collection of wild relatives of cacao suitable for breeding material. The development of a rapid method of diagnosis, such as the use of indicator plants or serological tests, would permit an earlier detection of infected trees. Suggestions are given for the control of vectors.

Since the carrying out of this programme is essential to the maintenance of the cocoa industry in the Gold Coast, the facilities and land attached to the Institute should be extended and its personnel increased to make it effective; the educational programme requires extension to establish better contact between farmers and scientists.

Ekstrand (H.). **Några växtpatologiska synpunkter på övervintringen av höstsäd och vallgräs med särskild hänsyn till försöksverksamheten inom jordbruket.** [Some phytopathological aspects of the overwintering of autumn cereals and forage grasses, with special reference to experimental work in agriculture.]— *Medd. Växtskyddsanst., Stockh.*, 49, 48 pp., 1 fig., 1947. [English summary.]

This is a summary of ten years' (1937 to 1947) contributions by the author and others to the phytopathological aspects of the overwintering of autumn cereals and forage grasses in Sweden [*R.A.M.*, xxviii, p. 9].

It appears from extensive tests carried out in different localities that rye losses due to *Calonectria graminicola* were generally much less severe when treated seed was used. Seed dressing is considered to be essential for overwintering cereal and storage crops, although it caused little reduction in rye losses from *Sclerotinia*

borealis while those due to *Typhula borealis* were higher after seed treatments. However, the author stresses the importance of seed infection by *C. graminicola* as this is related to losses from snow mould damage even among the more resistant varieties. He suggests that the analysis certificate from the Seed Control Station should state the degree of seed infection for non-dressed seed.

In conclusion it is recommended that dressed seed with low snow mould infection from resistant varieties grown in the cultivation area should be used, attention being paid to suitable fertilizers, particularly phosphate. In further breeding programmes resistance to winter fungi should be considered and selection work carried out locally.

Rütti (R.). **Beobachtungen über den Schwarzrost (Puccinia graminis) unter besonderer Berücksichtigung der Entwicklungsbedingungen im Kanton Graubünden.** [Observations on black rust (*Puccinia graminis*) with special reference to the conditions for its development in the canton of Grisons.]—*Schweiz. landw. Mh.*, xxiv, 8, pp. 233–247, 4 figs., 1946. [Received, 1949.]

Some general remarks on the history, biology, and parasitism of cereal black rust (*Puccinia graminis*) are followed by an examination of the conditions promoting its epidemic development in the canton of Grisons, Switzerland [*R.A.M.*, xxvii, p. 220], where the disease was responsible for substantial losses in 1945. Severe outbreaks may be expected to follow heavy precipitation coupled with high temperatures in the late spring and early summer, while other favouring factors incidental to the Alpine climate are fluctuations in diurnal temperature, copious dew formation, and the general practice of cultivation in hollows. Huron summer wheat and Goldregen oats are the most susceptible varieties, spelt and winter wheat, Fichtelgebirg and Alaska oats, rye, and barley generally sustaining less damage.

The perpetuation of *P. graminis* in Grisons is effected exclusively through its alternate host, the barberry, overwintering by means of uredospores being out of the question. The extermination of the shrubs, which grow, for instance, among the stone heaps between the fields, along railway cuttings and streets, and on slopes up to an altitude of 1,800 m., presents great difficulties. A count of the barberries in the parish of Filisur resulted in the location of 2,000 on cultivated land or 175 per ha. oats and wheat. Cultural measures contributing indirectly to resistance through early maturing and a robust habit of growth include timely sowing with medium spacing and the use of potash and phosphorus as soil amendments.

Singh (R. D.). **Triticum sphaerococcum Perc. (Indian dwarf Wheat).**—*Indian J. Genet. Pl. Breed.*, vi, 2, pp. 34–47, 1946. [Received February, 1949.]

Data collected over a number of years at the Cereal Section of the Punjab Agricultural College and Research Institute, Lyallpur, show that *Triticum sphaerococcum* wheats are very susceptible to *Puccinia triticina* and *P. glumarum* [*R.A.M.*, xxvii, p. 358] and *P. graminis* [ibid., iii, p. 325; xxviii, p. 12]. They are as susceptible to loose smut (*Ustilago tritici*) [ibid., xxvii, p. 315] as the *vulgare* wheats. Counts made at the Cereal Breeding Farm, Lyallpur, in March, 1944, on seven strains of *T. sphaerococcum* raised from aerially infected seed of the previous season, showed a smut incidence ranging from 0·2 to 9·3 per cent.

Batts (C. C. V.). **Black rust in south-east Scotland.**—*Nature, Lond.*, clxiii, 4133, p. 107, 1949.

In south-eastern Scotland the past few seasons have been notable for attacks of *Puccinia graminis* on cereals. In 1947, infection was particularly widespread and severe. Investigation showed that the common barberry [*Berberis vulgaris*] is frequently present in the local hedges, and is especially common in the Border districts. Wheat and barley seldom show severe infection, but oats in the immediate

neighbourhood of barberry bushes are often seriously affected. In 1948, *P. graminis* was noted on *Poa trivialis* and *P. pratensis*, apparently the first record of *Puccinia graminis poae* in Britain. Both species of *Poa* were growing near infected barberry. The serious losses caused by the rust in the vicinity of barberries suggest that a barberry eradication campaign would be highly beneficial in south-eastern Scotland.

Vallega (J.) & Favret (E.). **Razas fisiológicas de Puccinia graminis tritici que atacan a Triticum timopheevi.** [Physiologic races of *Puccinia graminis tritici* which attack *Triticum timopheevi*.]—*Rev. Invest. agríc., B. Aires*, i, 3, pp. 111–118, 1 pl., 1947.

Triticum timopheevi, which has shown marked resistance to *Puccinia graminis tritici* in the U.S.S.R. (its country of origin) [*R.A.M.*, xiv, p. 224] and North America [ibid., xxvi, p. 193] and been of great value in hybridization programmes, has proved susceptible to the rust in Argentina. Races 15 and 17 were the only ones isolated from field plants, but greenhouse inoculations were also successful with 42 and 11 [cf. ibid., xxii, pp. 57, 348; xxiv, p. 142].

The reactions of *T. timopheevi* and other wheat varieties to the four endemic races of *P.g. tritici* are considered to afford incontestable proof of the existence in Argentina of 15B (already recorded for Peru [ibid., xxv, p. 62] and Chile [ibid., xxvi, p. 150]), as well as of the difference between the native isolates of 17 and 11 and those described from North America.

Hockley (S. R.). **Glenwari : a new rust-resistant Wheat.**—*J. Agric. S. Aust.*, lii, 4, p. 173, 1948.

A new, high-yielding wheat variety, Glenwari, which is resistant to stem [black] rust [*Puccinia graminis*: *R.A.M.*, xxvii, p. 517] has recently been made available to farmers in South Australia. It was selected from the cross Nabawa × (Riverina × Hope), as (39–129), the same cross producing (38–356) [ibid., xxiii, p. 248] which is still under test. Glenwari is also resistant to flag smut [*Urocystis tritici*] and leaf rust [*P. triticina*]. In severe epidemics it may show late infection by black rust, but its yield remains unimpaired.

Butler (F. C.). **Stem rust of Wheat. Value of resistant varieties.**—*Agric. Gaz. N.S.W.*, lix, 10, pp. 511–514, 520, 1 map, 1948.

Stem [black] rust (*Puccinia graminis*) in New South Wales [*R.A.M.*, xxvi, p. 98] caused severe epidemics in the seasons 1903–4, 1916–17, 1920–1, 1925–6, 1930–1, and 1934–5, the estimated bushel losses being 3,000,000, 8,300,000, 1,600,000, 3,000,000, 2,000,000, and 3,000,000, respectively. During the 1947–8 season, the weather conditions were most favourable for the development of the disease, especially in the north-west and central west, where it caused yield reductions of 20 to 25 per cent., and an unprecedented total loss of 10,152,000 bush. was experienced. The damage would have been much greater had not slightly more than 50 per cent. of the acreage in the northern part of the wheat belt been sown with resistant varieties [loc. cit.]. It is strongly recommended that these varieties, which have shown a wide adaptability range, should be grown increasingly throughout the wheat districts, and details for the sowings in the various zones are given.

Cass Smith (W. P.). **Autumn rainfall in relation to spring epidemics of Wheat stem rust. A note on the occurrence of a localised outbreak.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xxv, 3, pp. 291–293, 1948.

The hypothesis that epidemics of stem [black] rust of wheat [*Puccinia graminis*] in Western Australia develop only after unusually heavy rainfall between January

and April [*R.A.M.*, xxvii, p. 12], followed by favourable conditions in spring and early summer, has been strongly supported by the occurrence of a localized outbreak on two farms in the Wongoondy area in 1947, which received a heavy thunder-storm in March.

It is suggested that in such years a warning might be issued to enable farmers to plant rust-resistant varieties. However, until long-range weather forecasts are available, it is impossible to predict with accuracy the course the rust development will take in spring or early summer.

El-Helaly (A. F.). **The influence of cultural conditions on flag smut of Wheat.**—*Phytopathology*, xxxviii, 9, pp. 688–697, 1 graph, 1948.

The average reduction in the Egyptian wheat crop from flag smut (*Urocystis tritici*) does not exceed 5 per cent., but losses of 50 per cent. and upwards may be sustained under certain conditions. The incidence of the disease reaches a maximum in the Delta, decreasing gradually southwards into Upper Egypt, where it is rare [*R.A.M.*, xix, p. 393]. The principal factors concerned in the distribution and spread of the pathogen are the date and method of sowing, soil amendments, and smut spore load on the seed.

In 1940–1 and 1941–2 inoculated seed of the susceptible Hindi D variety was sown on 1st and 15th October, 1st and 15th November, and 1st and 15th December in artificially infested plots at a field station of the Ministry of Agriculture, Dokki. Early-sown plants were almost free from flag smut, which reached a peak of 50 per cent. in the sowings of 1st December; the curves indicate that temperature is an important determining factor.

The 'herati' method of sowing was again shown to be more conducive to flag smut development than the 'afir' [ibid., xix, p. 392]. In the former the seed is sown on moderately damp soil, which is left without irrigation for about a month, while in the latter the dry soil is irrigated immediately after sowing. In 1940–1 the incidence of infection in the 'afir' and 'herati' sowings (four of each) was 4 to 5 and 9 to 12 per cent., respectively, while the corresponding figures in 1941–2 were 2 to 10 and 15 to 34 per cent., respectively. The watering which follows sowing in the 'afir' method may remove, in the course of drainage, the bulk of the spores adhering to the seed coat, while possibly the slightly lower soil temperature is likewise detrimental to the fungus. Deep sowing has been found by previous workers to promote flag smut infection: in the 'herati' and 'afir' methods the seed is buried to average depths of 8 and 4 cm., respectively. In experiments in 1942–3 at the Farouk I University, Alexandria, to ascertain the effect of sowing depths at seven intervals from 0·5 to 20 cm. on the incidence of flag smut on three wheat varieties, using the 'herati' method, the infection percentages rose parallel with increasing depth, ranging from 9 to 52 in Hindi D, 8 to 66 in Mabrouk, and 5 to 55 in Hindi 62. Another factor tending to favour the pathogen in the 'herati' procedure is the irrigation 8 to 15 days before sowing, giving the spores a natural pre-soaking to fit them for germination and infection on contact with the seed. In the case of 'afir', on the contrary, the soil has usually dried out 40 to 50 days before sowing, and the delay in spore germination due to insufficient moisture may give less scope for seedling infection.

All the manurial treatments used in the experiments increased the amount of flag smut. The number of rakings (up to four) did not influence the development of infection to any appreciable extent. On the other hand, in two experiments to determine the effect of increasing the spore load on Hindi D seed at five intervals from 0·001 to 10 gm., the percentage of smutted plants per plot of 2 by 5 m. rose from 0·3 at the minimum to 19·9 at the maximum in 1940–1 and from 9·1 to 82 in 1941–2.

In an experiment to ascertain the reaction of eight wheat varieties to *U. tritici*, using inoculated seed and the 'herati' sowing method, three were immune, namely,

Baladi 116, Baladi 'Bouhi', and Kazouria Taliani, while the percentage of infection in the five others (four types of Hindi and Mabrouk) ranged from 26·8 to 45·8.

Partial control of flag smut, without damage to germination of the treated seed or growth of the plants, was effected by immersion in 0·5 per cent. germisan and 0·5 per cent. uspulun, and by dusting with flowers of sulphur (5 and 10 gm. per kg. seed), copper carbonate (5 and 10 gm.), and agrosan G (2·5, 5, and 10 gm.). In 1940–1 these treatments reduced the percentage of flag smut in non-infested soil from 12·7 as follows: germisan 7·9, uspulun 4·8, the two concentrations of flowers of sulphur 5·3 and 7·1, the two of copper carbonate 6 and 5·3, and the three of agrosan G 3·7, 2·8, and 4·3. The following were the corresponding figures in infested soil: control 17·2, germisan 5·5, uspulun 5·9, flowers of sulphur 8·9 and 5·2, copper carbonate 4·4 and 5·1, and agrosan G 5·9, 3·9, and 2·5. In 1941–2, when there was 58·5 per cent. flag smut in the control plots in non-infested soil, the percentages for the treatments (uspulun omitted) were as follows: germisan 23·5, flowers of sulphur (10 gm.) 27·3, copper carbonate (10 gm.) 32, and agrosan G (5 gm.) 29·1. In infested soil infection in the untreated plots reached 86 per cent. and was reduced to 43·1, 27·3, 44, and 39·6 by the respective treatments.

Garrett (S. D.) & Mann (H. H.). **Soil conditions and the take-all disease of Wheat. X. Control of the disease under continuous cultivation of a spring-sown cereal.** —*Ann. appl. Biol.*, xxxv, 3, pp. 435–442, 1948.

In a field experiment on the control of take-all (*Ophiobolus graminis*) [*R.A.M.*, xxvii, p. 418], carried out at the Woburn Experimental Station, Bletchley, winter wheat was followed by two consecutive crops of spring-sown barley. Samples of the barley crop were taken from the 48 plots of the experiment in 1945 and 1946 and the root disease rating was estimated and the grain yield recorded.

A comparison of six autumn treatments of the stubble showed that those affecting the available nitrogen content of the soil exercised a predominant effect upon incidence of take-all in the following crop. Autumn applications of nitrogen fertilizers had an immediate effect in assisting the survival of *O. graminis* in infected root and stubble residues, and when subsequently released by the decomposition of straw or trefoil residues, a deferred effect, in promoting freedom from disease in the following crop.

The ploughing-in of straw in autumn caused an increase in the incidence of take-all in the following season, presumably because the decomposing straw locked up available nitrogen and withheld it from the following crop and this adverse deferred effect outweighed the immediate beneficial effect, namely, that of helping to starve out *O. graminis* by depriving the fungus of nitrogen. Active autumn growth of undersown trefoil (*Medicago lupulina*) on stubble land appeared to assist in starving out *O. graminis* [ibid., xxvii, p. 182]. The nitrogen was subsequently released by the decomposition of the trefoil in the soil after spring ploughing in time to benefit the barley crop immediately following.

Wahlin (B.). **Några iakttagelser av stråbassjukdomar hos Vete.** [Some observations on Wheat foot rot.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1948*, 4, pp. 56–60, 2 figs., 1948.

In east Gothland, Sweden, take-all and whiteheads (*Ophiobolus graminis*) occurred in an exceptionally severe form in 1948 on the summer wheat crops, probably as a result of damp, cool weather in the early part of the season, combined with the prevailing shortage of nitrogenous fertilizers. Eyespot (*Cercosporella herpotrichoides*), which is ordinarily unimportant in the region, was also responsible for sporadic lodging of wheat [cf. *R.A.M.*, xxvii, p. 467]. In most cases the affected crops had been preceded by wheat or barley, but in some of the fields even a two-year rotation had not sufficed to eliminate the pathogens from the soil.

Butler (F. C.). **Frost injury of Wheat.**—*Agric. Gaz. N.S.W.*, lix, 8, pp. 415–418, 426, 8 figs.; 9, pp. 481–484, 1948.

Frost injury causes more consistent annual wheat losses in New South Wales than any parasitic disease. The wheat plant is subject to damage at any stage from germination until the grain is in the late dough stage and especially at the pre-heading and flowering. Frosted oat and barley plants suffer from similar symptoms. Injured leaves appear distorted, blighted, parched, and brittle, with in-rolling of the margins of tip-frosted leaves. Stem injury is characterized by browning of the lower nodes and internodes accompanied by buckling, distortion, splitting, and rupturing. The central stem cavity is dark reddish or chocolate-brown. Other common symptoms are a 'silvering' or blistering effect on the upper side of the nodes and white ring barking of the stem frequently accompanied by bareness at the base of the ear. A brown or whitish-brown discoloration of the internal tissues seen in cross-section is a useful indicator of frost injury in the pre-heading stage. The head commonly suffers from complete blighting, resulting in a white, bleached condition, or partial frosting when the tip, central, or basal portions of the ear may be blighted and shrivelled, while other symptoms include failure of the lower spikelets, resulting in bareness at the base of the ear, a wide-open appearance of the glumes, complete or partial failure of the grain to develop, transparency of the ears, and shrivelling and cracking of the grain.

In the second article the symptoms of frost injury are compared with the effect of hot drying winds, take-all [*Ophiobolus graminis*: *R.A.M.*, xxvii, p. 559], and foot root [? *Fusarium* spp.]. Factors predisposing to frost injury and varietal susceptibility are also discussed. Although frost damage cannot be entirely avoided in the absence of resistant varieties, losses can be minimized by the late-sowing of early-maturing varieties such as Gabo, Geeralying, Gular, Ranee, Rapier, Sword, Bobin, Cailloux, Duri, Pusa III, and Pusa 4 in a firm, well-compacted seed-bed, feeding off rank and forward crops, sowing very frost-susceptible varieties such as Charter, Ford, Pusa 4, Kendee, and Gabo on elevated sites, watering on irrigable land when frost is imminent, and cutting down extensively damaged crops after spring frosts.

Favret (E. A.). **Hallazgo de una nueva raza de Erysiphe graminis hordei.** [Discovery of a new race of *Erysiphe graminis hordei*.]—*Rev. Invest. agríc., B. Aires*, I, 3, pp. 237–240, 1947.

In September, 1946, the writer was informed that selections 35–4 and 35–5 of the Anoidum barley variety, which is highly resistant to race Arg. 1 of *Erysiphe graminis hordei*, were severely attacked by the mildew at the Institute of Genetics, Buenos Aires. A new race, Arg. 2, different from any hitherto described, was isolated from samples of the diseased material.

Among over 200 varieties tested for their reaction to the new race, Monte Cristo, Engledow India, and the wild barley, *Hordeum spontaneum*, were immune; Multau × Glabron, extremely resistant; Nigrate, Gopal, Psaknon, and Lion × Palmella highly resistant; and *H. distichum nigrinudum*, Arlington Awnless, Importada Brügger, and Duplex moderately resistant. An analysis of the reaction to Arg. 2 of 101 F_3 families of the cross between Monte Cristo C.I. 1017 and Trebi Sel. Klein (susceptible) showed the immunity of the former to be governed by a main dominant gene identical with that conferring the same response to Arg. 1 and designated Oi MC.

Pathology and mycology of Corn.—*Rep. Ia agric. Exp. Sta., 1946–47*, Part II, pp. 348–351, 1947.

G. Semeniuk and I. E. Melhus [cf. *R.A.M.*, xxvi, p. 391] state that greenhouse

and laboratory hypodermic inoculations of young maize plumules with monosporidial isolates of each of the smuts found on inflorescences of teosinte [*Euchlaena mexicana*] and *Tripsacum* in Guatemala in 1946, and of *Ustilago zeae* [*U. maydis*] resulted in gall formation by *U. maydis* and the *Tripsacum* smut but not by the teosinte smut. Infestation of maize and teosinte grain with *U. maydis* and the *Tripsacum* smut induced galls on the resulting seedlings, but the teosinte smut, which resembles *Sphacelotheca reiliana* [ibid., xxviii, p. 116], failed to do so.

Isolations from maize plants during August and September, 1946, yielded, in descending order of frequency, *Pythium graminicola* from all underground parts and up to the third node above ground, *Gibberella saubinetii* [*G. zeae*: ibid., xxvii, pp. 278, 510] from the small roots, cortex and stele of the secondary roots, and up to the second node above ground, *Fusarium* spp. from small root tips, steles of secondary roots, and the first node above ground, and *Rhizoctonia* sp. from the root tips and steles of secondary roots.

G. Semeniuk, C. S. Reddy, W. E. Loomis, J. R. Wallin, E. W. Lindstrom, and G. F. Sprague report a further slight occurrence of a phyllody and witches' broom development in Iowa maize fields during the summer of 1946. Seedlings artificially infected with *Sclerospora graminicola* failed to develop the condition when transplanted to the field during 1946. Many plants which were chlorotic and hence infected with *S. graminicola* in the early seedling stages soon outgrew this condition and developed into normal plants. Others, mainly inbred lines, soon died or became stunted. Susceptibility differences to *S. graminicola* among inbred lines were noted in greenhouse trials. Seeds from one naturally occurring phyllodous plant developed into dwarfed, virescent seedlings in the greenhouse.

In tests conducted by I. E. Melhus, G. Semeniuk, C. S. Reddy, J. R. Wallin, and J. M. Green in June, 1946, one-month-old plants of 32 single crosses, 48 inbred lines, and 100 Guatemalan open-pollinated plants were evaluated for necrosis of the primary roots [due to *P. graminicola*]. The percentage ranged from 26 per cent. for inbred Ohio 40B to 86 per cent. for inbred R4. The inbred lines were more severely diseased than either of the U.S. single crosses or the Guatemalan maize. None of the plants was immune, but there were great differences in susceptibility, especially among the Guatemalan plants.

Leukel (R. W.). **Periconia circinata and its relation to Milo disease.**—*J. agric. Res.*, lxxvii, 7–8, pp. 201–222, 13 figs., 1948.

Milo [sorghum] disease [*R.A.M.*, xxvi, p. 541] was first recognized in Texas in 1924. Repeated inoculation experiments at the Plant Industry Station, Beltsville, Maryland, with *Pythium arrhenomanes* [ibid., xxiii, p. 101], previously thought to be the causal organism, established that this fungus does not cause typical milo disease. It is, however, especially injurious to the finer roots of sorghum, both resistant and susceptible varieties being equally prone to attack.

In tests in which steam-sterilized soil was inoculated with various fungi isolated from the roots of susceptible sorghum plants, grown in naturally infested soil, only *Periconia circinata* [ibid., xxvi, p. 542] produced typical milo disease in all susceptible selections or varieties tested; it failed to affect the resistant ones. The severity of injury was more or less proportional to the amount of inoculum used.

P. circinata produces a virulent, relatively thermostable toxin that kills the plant cells in the absence of the fungus mycelium. It is possible that the fungus is a saprophyte like most other species of the genus and that it grows on the cells killed by the toxin.

P. circinata grows slowly on artificial culture media. Its cardinal temperatures for growth in culture appear to be about 10°, 25°, and 40° C. On potato dextrose agar it produces a dirty-white to mouse-grey mycelium of slender hyaline threads and thicker-walled fruiting hyphae. The thick-walled, generally smooth, somewhat

cylindrical, terminal or intercalary chlamydospores, which occur singly or in chains, measure 9 to 18 μ in diameter and contain conspicuous oil globules. The dark, thick-walled, three- to ten-septate conidiophores, circinate near the apex, measure 150 to 250 by 6 to 8 μ. The mostly spherical, coarsely verrucose to spiny, dark brown conidia measure 15 to 27 (usually 18 to 21) μ.

KHAN (I. U.). **A technique for growing Citrus seedlings under aseptic conditions of culture.**—*Phytopathology*, xxxviii, 9, pp. 756–757, 1 fig., 1948.

In connexion with studies on damping-off (*Rhizoctonia* [*Corticium*] *solani*) at the California Citrus Experiment Station a method was devised to replace the standard procedure for the germination of citrus seeds on sterile agar in test tubes, which has several disadvantages. With a blow-torch a hole about $\frac{1}{8}$ in. in diameter was made in the bottom of a test-tube 6 by $\frac{3}{4}$ in. A cotton-thread wick, $1\frac{1}{2}$ by $\frac{1}{8}$ in., knotted at one end, was inserted through the hole so that the knot rested within the tube, which was filled with previously washed and dried fine quartz sand to a depth of $1\frac{1}{2}$ in. The tube was then placed in a larger tube (8 by 1 in.) on a 1-in. piece of glass rod with 15 ml. nutrient culture solution in the bottom. The larger tube was plugged with cotton wool and autoclaved at 15 lb. pressure for 20 minutes. After the contents of the tube had cooled one seed per tube was planted aseptically and incubated at 31° to 33° C. The sand saturated with nutrient solution not only supplied enough moisture for seed germination, a process requiring 15 to 30 days under favourable conditions, but also fed the young roots for at least two months, during which inoculation tests could easily be concluded. Using this apparatus, with the pH of the nutrient between 4·85 to 8·85 and an incubation temperature of 25°, a virulent strain of *C. solani* will damp-off sweet orange seedlings within three to five days after inoculation.

WEINDLING (R.). **Bacterial blight of Cotton under conditions of artificial inoculation.**—*Tech. Bull. U.S. Dep. Agric.* 956, 59 pp., 8 pl., 1948.

The investigations on bacterial blight [blackarm] of cotton (*Xanthomonas malvacearum*) herein fully described and tabulated were carried out from 1942 to 1945 and were concerned primarily with (1) the host-parasite relationships fundamental in epidemics of the disease [*R.A.M.*, xxvii, p. 183], involving intensive studies on individual leaf infection; and (2) methods for the production of epidemics by artificial inoculation, including greenhouse and field experiments on epidemiology.

Severe infection of expanded leaves was found to depend on an inoculation technique permitting the rapid penetration of large bacterial masses through the stomata into susceptible tissues. The extent of water congestion in the intercellular spaces is an important factor in the success of inoculation [cf. ibid., xxviii, p. 25]. If the leaf tissues are visibly water-congested at the time of inoculation they become entirely diseased, otherwise infection develops in the form of scattered spots. The larger the numbers of bacteria introduced into the tissue, the shorter was the incubation period and the more severe the disease. Hydrosis, the first symptom, becomes apparent when the masses of bacteria have built up to a point in which they, together with the water or cell sap withdrawn from the surrounding cells, practically fill the intercellular spaces. Thus, incubation is subject to a biological mass effect, while invasion appears to depend on physical mass effects, such as the number of liquid passages and the forces with which the bacteria are drawn into the infection courts. These factors again seem to be governed by the extent of temporary water congestion and this in turn on the water pressure effective at the leaf surface. Susceptibility or resistance to *X. malvacearum* appears to be related to the degree of compatibility of host tissue and parasite. In susceptible tissues the

bacteria spread from a given infection court into the surrounding leaf areas, whereas in resistant ones their action is limited to small spots or may even not result in perceptible lesions.

Epidemics have been induced in the field by spraying plants with bacterial suspensions, using a knapsack or wheelbarrow sprayer and observing the following rules: (1) the open stomata to be spray-inoculated in mid-morning; (2) pressure to be applied by holding the nozzle close to the leaves to produce water congestion; (3) 1,000,000 bacteria per ml. to be used as inoculum; and (4) plants in good growing condition, five to eight weeks old, should be used to provide susceptible tissue. Leaf spot served as the principal indicator of relative resistance in grading inoculated field plants into three classes, susceptible, including (S × P), Shafter Acala, Acala 11, and Trice 2A; tolerant, represented by Coker 100 wilt, Stoneville 37, and Stoneville 4–15; and resistant (Stoneville 20 and hybrid back-cross). There is general agreement with regard to relative varietal resistance in the several phases of bacterial blight—leaf spot, blackarm, boll rot, and seedling blight—but deviations have been noted and therefore stem and boll reactions should also be considered in breeding programmes.

Field experiments were conducted on the effects of various factors which had first been studied on greenhouse plants. Mild forms of the disease developed when (1) the plants were sprayed late in the evening; (2) the spray was applied as a mist; and (3) the plants were old or in poor growing condition. In parallel greenhouse tests it was observed that the leaves of susceptible varieties which were in the bud stage at the time of inoculation contracted rather severe infection, even when no force was used in the application of the inoculum. Methods of artificial inoculation simulated natural inoculation during rains. Application in mist form corresponds to a gentle rain; fine spray, applied as described above, to driving rain; and coarse spray to a rain-storm. The last-named was not much more effective on the foliage than the fine spray, but on bolls and stems it produced much heavier infection. Evidence was obtained that mild infections, especially those of bud leaves and seedlings, may be seriously aggravated by treatments simulating dew and frequent gentle rains, such as exposure to high humidity or frequent sprinkling after inoculation. These procedures may be used to supplement the more severe methods recommended for the inoculation of breeding plots. The latter, however, have the advantage of excluding escapes from the disease, as they produce symptoms in the most resistant upland varieties known. Comparative studies of inoculation methods simulating different natural conditions may also be useful in further investigations on the epidemiology of the disease. The boll rot and blackarm phases, in particular, require further elucidation.

Machacek (J. E.) & Greaney (F. J.). **Summary of co-operative experiments on treatment of Flax seed.**—*Phytopathology*, xxxviii, 10, pp. 803–807, 1 fig., 1948.

Co-operative tests of various treatments, applied to sound and fractured flax seed, were conducted from 1944 to 1946, inclusive, over a wide area of Canada (13 experiment stations participating) and in the northern part of the United States (eight stations) [*R.A.M.*, xxv, p. 560]. The resultant data indicate that such treatment is advisable, especially when a considerable proportion of the seeds are fractured. In these cases the application of a protectant, especially new improved ceresan, generally increased germination and occasionally raised the yield. The dosage of $\frac{1}{2}$ oz. per bush. of new improved ceresan, recommended in the United States, should be increased to at least 1 oz. per bush, as generally used in the drier parts of western Canada, to ensure maximum efficiency. Significant increases of yield were also obtained with Du Bay 1452 F and arasan, but they were not equal to those given by new improved ceresan.

Colhoun (J.) & Muskett (A. E.). **A study of the longevity of the seed-borne parasites of Flax in relation to the storage of the seed.**—*Ann. appl. Biol.*, xxxv, 3, pp. 429–434, 4 graphs, 1948.

Tests carried out in Northern Ireland from 1939 to 1947 with flax seed held under ordinary conditions of storage and naturally contaminated to different extents with the seed-borne parasites *Colletotrichum linicola* [*R.A.M.*, xxvii, p. 236], *Polyspora lini* [ibid., xxvii, p. 523], *Botrytis cinerea*, and *Phoma* sp. showed that the longevity of the fungi varied from 26 to 69 months, 16 to 55 months, 16 to 40 months, and 27 to 43 months, respectively. The data indicate that the higher the percentage number of seeds contaminated with *P. lini*, the longer will be the time taken for the parasite to die. As the time taken for the deactivation of the parasites is usually much longer than that for which flax seed for sowing purposes can safely be stored, prolonged seed storage is not recommended as a likely method of controlling seed-borne diseases of flax. The germinative capacity of the seed was usually seriously impaired by the time all the parasites had died.

Frederiksen (P. S.). **Hørrustens Udbredelse, Skadevirkning og Bekaempelse. En Fare for vor Spindhørdyrkning !** [The distribution, injurious effect, and control of Flax rust. A menace to our spinning Flax cultivation!]—Reprinted from *Ugeskr. Landm., 1948*, 18–19, 8 pp., 4 figs., 1 map, 1948.

Flax rust (*Melampsora lini*) is stated to have spread widely in Denmark [*R.A.M.*, xxii, p. 433] with the greatly extended cultivation of the crop, especially in Jutland, and at the moment the disease is one of the most urgent problems of the spinning industry. The uredosori begin to develop on the leaves about 1st July, and under favourable weather conditions they cover the entire crop within the next 10 to 14 days. About a month later the teleutospores of the rust are formed on the straw, which is rendered unfit for scutching by severe infection. In such cases the fibres are completely disorganized, the clearly delimited cells of the normal structure being replaced by an amorphous mass in which a marked woodiness of the tissues among the remnants of the fibres is revealed by staining with phloroglucin-hydrochloric acid. Not only do the weakened fibres break in the process of scutching, but the spores adhere firmly to them and impede the work of spinning. A five-year survey of the spinning crops in 11 districts revealed the following averages of mild and severe infection and total destruction: 1942, 5·2, 1·7, and 0 per cent., respectively; 1943, 20·8, 11·3, and 0·8; 1944, 29·3, 15·9, and 0·3; 1945, 26·1, 17·4, and 1·2; and 1946, 16·7, 24·8, and 1·5. The tendency to increasing damage from the beginning to the end of the period corresponds to a rise in the mean rainfall for June at 11 stations (one in each district), viz., 34 mm. in 1942, 65 in 1943, 75 in 1944, 76 in 1945, and 121 in 1946. The high atmospheric humidity and succulent growth habit thus induced favoured an access of virulence in the rust.

Since it is mainly the fibres that are injured by rust, the economic importance of the damage to the linseed oil crop is slighter. On the other hand, the longer growing period of the latter predisposes it to heavy infection, which no doubt increases the risk to the adjacent spinning crops.

The control of *M. lini* should be based on clean cultivation, appropriate cultural methods, and the use of resistant varieties. The straw is the sole means of perpetuation of the rust, and therefore the flax should be carefully pulled, taking care to leave as little straw as possible on the ground; the straw should not be dragged into adjacent fields carrying winter crops or spilt in transport from field to warehouse or from warehouse to factory; the stubble should be thoroughly ploughed under to a sufficient depth to be covered and not brought to the surface in the course of preparation for sowing in the following spring; the overwintering stacks should not be left standing long enough for the rust to spread from them to the neighbouring

flax fields in the spring; and infected material should not be used as a covering for winter crops. The site for the new season's crop should be located as far as possible from that of the previous year and perhaps protected by a belt of barley; the seed should be sown as early as circumstances permit; potash should be liberally and nitrogen sparingly applied to the soil; and cultivation should be strictly avoided in low-lying areas rich in humus, e.g., marsh- and meadowland, where the rust thrives and which may serve as breeding-grounds for the dissemination of infection over a wide radius. Breeding for resistance to *M. lini* is complicated by the strictly obligate character of the rust, but it is simplified, on the other hand, by the dominance of resistance and its dependence, in respect of every known physiologic race, on one, two, or at most three pairs of genes [ibid., xxvi, p. 489]. A national breeding programme to provide immune or highly resistant flax varieties for the Danish spinning industry should be promptly laid down and adhered to in the future.

Bazan de Segura (Consuelo). **Nuevas enfermedades del Lino en el Perú.** [New Flax diseases in Peru.]—*Bol. Estac. exp. agríc., Lima*, 36, 36 pp., 13 figs. (3 col.), 1947. [Received January, 1949.]

Two new flax diseases are reported from the Agricultural Experiment Station 'La Molina', Lima, Peru, namely, sclerotiniosis (*Sclerotina sclerotiorum*) and anthracnose (*Colletotrichum linicola*), with observations on their symptomatology and control and on the morphological and cultural characters of the causal organisms.

Smith (F. F.) & Brierley (P.). **Aphid transmission of Lily viruses during storage of the bulbs.**—*Phytopathology*, xxxviii, 10, pp. 841–844, 1948.

An outbreak of lily mottle [tulip breaking] virus [*R.A.M.*, xxiv, p. 59] in the planting of an Oregon grower who had produced virus-free *Lilium formosanum* under suitable isolation for several years could not be traced to any source near the field. It was reported, however, that bulbs of this species had been graded and cleaned in the same storehouse with those of *L. candidum* grown elsewhere. Experiments were therefore planned to ascertain whether *Aphis gossypii* and *Myzus persicae* would colonize on lily bulbs during storage, whether the former could transmit from sprout to sprout the persistent lily rosette virus [ibid., xxiv, p. 276], and if the latter could convey the non-persistent tulip breaking and cucumber mosaic viruses from diseased to healthy plants.

The tulip breaking virus was procured from naturally infected stock of the Creole variety of *L. longiflorum* originating in Florida. The virus from this source resembles and may be identical with that common in *L. candidum*. A strain of cucumber mosaic virus, isolated in the first place from necrotic-flecked stock [ibid., xxiv, p. 18] of *L. longiflorum* var. *harrisi* from Bermuda, was maintained in seedling *L. longiflorum*, which also served for the perpetuation of the rosette virus, originating in Florida Easter lilies. The tulip breaking and rosette viruses were tested on *L. formosanum* or *L. longiflorum* seedlings and cucumber mosaic on a stock of Creole lilies which was free from necrotic fleck but developed fleck symptoms on inoculation with cucumber mosaic virus [loc. cit.].

M. persicae was shown to be capable of acquiring the tulip breaking virus from the colourless sprouts and bulb scales of stored *L. longiflorum* bulbs and transmitting it to similar sprouts of Easter lily seedlings and to growing plants of the same species and *L. formosanum*. In a single trial, however, the aphid failed to introduce this virus into the bulb scales of *L. formosanum*. *M. circumflexus* proved unable to convey the tulip breaking virus from sprout to sprout in storage, just as it has consistently given negative results in plant-to-plant transmission experiments. Cucumber mosaic was readily transmitted by *M. persicae* from growing Easter lily to growing plants or sprouts of Creole lily in storage, typical necrotic fleck symp-

toms being induced in the Creole lilies in both tests. *A. gossypii* freely transmitted the lily rosette virus from sprout to sprout or from sprouts to growing Easter lily plants. This aphid appears to be capable of transmitting the virus during storage and carrying it to growing plants in neighbouring fields. Moreover, since *A. gossypii* readily settles on the shoots of stored bulbs, it may well be transported on them.

It is apparent from these data that both persistent and non-persistent lily viruses are communicable during storage of the bulbs by the appropriate insect vectors. In planning the segregation of tolerant and intolerant lily species, attention should be paid to the relation of the grading and storage facilities to the field plantings, and to the exclusion of aphids from the storehouse.

MacLean (N. A.). **New hosts for Botrytis elliptica.**—*Phytopathology*, xxxviii, 9, pp. 752–753, 2 figs., 1948.

Botrytis elliptica, the agent of leaf rot and spot of lilies [*R.A.M.*, xxv, p. 215], was observed in 1947 on two new hosts in western Washington, where it constitutes a potential threat to the expanding bulb and corm industry of the Pacific Northwest. They are *Colchicum autumnale* and the *Gladiolus* varieties Rosa van Lima, Greta Garbo, Bach, Anna Mae, Cave-Cole, and Jeannie.

The older leaves of *C. autumnale* were severely spotted, and the tips of the younger ones killed. The lesions were circular to elongate, brown to yellow-brown, with pale centres. The greyish-black spore masses found on all the affected parts consisted of hyaline, later olivaceous-brown conidiophores, bearing at their tips clusters of elliptical to elongate, hyaline, later light brown conidia which measured 17·5 to 35·5 by 10 to 14 (mean 28 by 10·5) μ.

The leaves of *Gladiolus* seedlings were often destroyed by the pathogen, the numerous spots formed by which were circular with a tendency to elongation, red to reddish-brown with slightly raised centres, and measured 2 to 5 mm. in diameter. No fruiting bodies were observed on the foliage in the field, but the typical conidia of *B. elliptica*, 20 to 34 by 10 to 16 (25 by 11) μ, in agreement with the published descriptions by Westerdijk and van Beyma [ibid., viii, p. 141] and Moore [ibid., xix, p. 153], developed in pure culture. Inoculation experiments on *Gladiolus* leaves resulted in the development of characteristic symptoms, beginning after five days at 20° C. in a moist chamber.

Lihnell (D.). **Lycopersicum Virus 3—ett for Sverige nytt Virus.** [*Lycopersicum* virus 3—a new virus for Sweden.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1948*, 4, pp. 49–53, 4 figs., 1948.

Samples of Calla lily (*Zantedeschia*) [*aethiopica*] received in November, 1947, from a nursery in the south of Sweden presented the typical symptoms of *Lycopersicum* virus 3 [tomato spotted wilt virus: *R.A.M.*, xxv, p. 396; xxvi, p. 231]. This is the first definite record of the occurrence of the virus in the country, although I. Jørstad states that in Norway it has been fairly prevalent and often troublesome on tomatoes for several years. Infection cannot be detected at the port of entry by inspection of the imported rhizomes, on which no symptoms are apparent, and probably the disease is already more widespread in Sweden than this single record would indicate. Stringent measures should be taken to prevent the extension of the virus, notably in the tomato-growing industry, by the control of its *Thrips* vectors with DDT emulsions, especially rotoxol E.

Harrison (T. H.). **Australia still free from true Gladiolus smut.**—*J. Aust. Inst. agric. Sci.*, xiv, 3, p. 147, 1948.

A re-examination by Dr. Herbert and J. H. Simmonds of the Queensland

infected *Gladiolus* material on which the presence of *Urocystis gladioli* [*R.A.M.*, xxv, p. 322] was reported, has shown that the identification was erroneous. Australia, therefore, is still free from the true gladiolus smut.

NOBLE (MARY). **Seed-borne diseases of Clover.**—*Trans. Brit. mycol. Soc.*, xxx, pp. 84–91, 2 pl., 1948.

The author considers that the *Sclerotinia* found on imported white clover seed and previously described as a minor form of *S. trifoliorum* [*R.A.M.*, viii, p. 110] is a new species, which she names *S. spermophila* n.sp. On damp seeds and on the germination of the ascospores of *S. spermophila* an imperfect state occurs which bears a superficial resemblance to *Botrytis anthophila* [ibid., xxv, pp. 455, 562]. Seeds kept damp usually give rise to a sclerotium which develops internally and later projects through the broken testa. The fungus grows readily in culture, forming sclerotia similar to those on the seed. On malt agar slopes growth often ceases when half the medium is covered by sclerotia, *Botrytis* spores occur occasionally, and microconidia develop abundantly. The fungus tends to grow anaerobically, often forming sclerotia, conidia, and microconidia under the surface of the medium. On oat agar slopes growth continues until the medium is covered by sclerotia, both conidial forms also being present. After about six weeks apothecia appear and mature on the slope. They also appear readily if sclerotia from culture are planted in sand and kept damp.

The occurrence of an imperfect state alone is sufficient to differentiate *S. spermophila* from *S. trifoliorum*, but the apothecia and sclerotia are distinctly smaller and the two species are quite different in culture. The latter grows rapidly on malt agar at room temperature and soon produces a few large sclerotia. At the same time, characteristic dark mycelial bands appear, stretching from the medium to the sides of the test tube. Microconidia do not form freely on malt agar, but on oat agar they eventually develop abundantly [cf. ibid., xviii, p. 628] as small cream-coloured masses; apothecia, apparently, do not form in culture. In its morphology, *S. spermophila* resembles *S. minor* and *S. sativa*, though these are not seed-borne. *B. anthophila* is seed-borne; on oat agar it develops a very distinct rosy tint, associated with the formation of masses of microconidia. These spores also develop in Dox agar but submerged in the medium and too sparsely to confer on it the rosy tint. While the aerial conidia resemble in shape those produced in clover anthers, the submerged ones are egg-shaped. A few sclerotia were noted on malt agar. The presence of *B. anthophila* on the seed cannot be detected by the naked eye, but when a sample is kept damp typical conidiophores grow freely out; sclerotia are never produced.

Because of the occurrence of the *Botrytis* stage, *S. spermophila* might have been included in *Botryotinia* [ibid., xxv, p. 235], but the sclerotium of *S. spermophila* appears to be of the *Sclerotinia* type, and the *Botrytis* stage is not of the *B. cinerea* type. Also, *S. spermophila* is homothallic. On all points, the fungus agrees with Nannfeldt's definition of *Sclerotinia* [cf. ibid., xi, p. 606].

The fungus is described as having black, irregular or often spherical sclerotia 0·5 to 1·5 mm. in diameter. The cinnamon-brown apothecia, 0·5 to 1·5 mm. in diameter, arise singly or in small groups from sclerotia, and are cup-shaped, later flat. The hairy stipe darkens to black at the base. The cylindrical asci measure 153 to 215 by 11 to 18 μ, and the ascospores (8) are usually uniseriate, ellipsoidal, hyaline, continuous, and measure 12 to 19 by 7 to 12 (13) μ. The paraphyses are branched at the base. The hyaline, oval to long conidia are (7) 10 to 18 by (4) 6 to 10 μ, and the hyaline, uniguttulate, globose microconidia, measuring approximately 3 μ in diameter, arise exogenously on penicilloid conidiophores. The fungus is known only from clover seed, in which it develops parasitically.

Davison (J. R.). **Lime-induced chlorosis of fruit trees on the Murrumbidgee Irrigation Area.**—*Agric. Gaz. N.S.W.*, lix, 8, pp. 410–413, 1948.

After tracing the history and describing the symptoms of lime-induced chlorosis of fruit trees on highly alkaline soils in certain parts of the Murrumbidgee Irrigation Area [*R.A.M.*, xxv, p. 1], the author describes injection tests in 1941 and 1946 on peach and quince trees which indicated that they were suffering from iron deficiency. Treatments by the crowbar method of applying iron sulphate to the soil 6 ft. out from the butt of the tree, by a similar method using a 1 in. soil auger to sink holes 18 in. deep so that a long, thin column of iron sulphate spans the depth of the root zone, and by top dressings at 4 lb. per tree were also used. The second method gave the most lasting improvement; the beneficial effect of the first method began to wear off after two months. The top-dressed plots showed no improvement although some iron was absorbed.

Guyon (G.). **Sur le dépérissement du Pommier de pré-verger dans le Massif Central.** [On wilt of Apple trees in meadowland orchards in the Massif Central.]—*Ann. agron., Paris*, N.S., xviii, 5, pp. 593–606, 1948.

The information in this paper has already been noticed from another source [*R.A.M.*, xxvii, p. 424].

Broadfoot (H.) & Whittaker (E. C.). **Superficial scald of Granny Smith Apples.**—*Agric. Gaz. N.S.W.*, lix, 8, pp. 407–409, 413, 3 figs., 1948.

After indicating the importance of preventing superficial scald in the extensively grown Granny Smith apples in New Zealand [*R.A.M.*, xxvi, p. 496; xxvii, p. 568] the authors describe the symptoms and methods of control under short and long storage periods by the use of oil-impregnated wraps, plain wraps, oiled sheets, or by wrapping alternate layers when there is a shortage of oiled paper.

Wallace (T.). **Note on the control of magnesium deficiency of Apples.**—*Rep. agric. hort. Res. Sta. Bristol, 1947*, pp. 58–61, [? 1948].

Experiments conducted since 1939 in various parts of Great Britain on the control of magnesium deficiency in apples have shown that annual dressings of magnesium sulphate (calcined kieserite, 4 or 5 cwt. per acre) usually corrected the condition after three or four seasons [*R.A.M.*, xxii, p. 438], whereas solid injections of the same material were ineffective. The best results were obtained with four to six fortnightly sprayings with a 2 per cent. solution of agricultural Epsom salts, plus spreader, commencing at petal fall. This treatment is recommended to growers for acute cases.

Crowdy (S. H.) & Forshaw (J. E.). **A newly recorded bark disease of Apple.**—*Rep. agric. hort. Res. Sta. Bristol, 1947*, pp. 156–157, 1 pl., [? 1948].

A bark disease, first observed 15 years ago on a White Tom Putt apple tree in an orchard at Stembridge, Somerset, has since spread to other trees in the same orchard and others in the district.

At first a small area of dry and cracked bark appears, which enlarges and becomes more deeply fissured and folded as it spreads round the branch. Simultaneously the diameter of the branch increases and a characteristic swollen canker is formed. Large bark scales may develop before the cankers extend, girdle the branch, and stretch sometimes up to 1 ft. Death may not necessarily follow; the tree on which the disease was first reported has survived, though its general condition is extremely poor. In many cases, however, the girdled branches are killed, and since the cankers occur only on large branches of trees over 20 years old (none were observed on branches up to five years), the damage is serious.

The cause of the disease is not known. Its distribution indicates that it is infectious in nature and it may therefore be a potential threat to apple production.

Crowdy (S. H.). **A progress report on the effect of certain organic acids on the growth of Nectria galligena.**—*Rep. agric. hort. Res. Sta. Bristol, 1947*, pp. 158–163, 12 figs., 1 graph, [? 1948].

This is a full account of a paper, a brief description of which has already been noticed [*R.A.M.*, xxvii, p. 285].

In preliminary field trials cankers caused by *Nectria galligena* on Worcester Pearmain apple trees were either cleaned prior to treatment by cutting out the necrotic tissue or treated without cleaning. Cryptonol (8-hydroxyquinoline sulphate) and phygon were used in addition to the growth substances. It appears that the presence of strong wound cambia in the peripheral tissues, especially in uncleaned cankers, checks the spread of the fungus and allows the development of the underlying xylem, which gives the best guide to the extent of healing.

Cankers treated with γ-indolyl 3-butyric acid, bis-(2-naphthoxy) acetic acid, and 4-chloro,3-5-dimethyl-phenoxyacetic acid showed improvement over the controls. It is suggested that within the limits of toxicity of the plant growth substances used, healing depends more on the stimulation of the callus than on the checking of the pathogen, although the 10 per cent. cryptonol treatment shows that the suppression of the pathogen can produce an essentially similar effect, even though the fungicide does not appear to stimulate callus formation.

Wenzl (H.). **Zweigschäden durch Sclerotinia laxa an Marille.** [Twig damage to Apricots from *Sclerotinia laxa.*]—*PflSch. Ber., Wien*, ii, 9–10, pp. 140–144, 2 figs., 1 diag., 1948. [English summary.]

Besides apricot twig and branch die-back originating in the rotted fruits and manifested by foliar wilting (*Sclerotinia laxa*) [*R.A.M.*, xxvii, p. 429], another form of the disease occurs in the orchards of Vienna and its environs. This can usually be detected only on dissection of the twig, the tissue of which shows brown, necrotic stripes extending up to 30 cm. both upwards and downwards from the point of attachment of the rotted fruit. The only perceptible symptom is the formation of wound tissue over the necrotic areas surrounding the point of attachment of the decayed, later mummified fruits, and even this is absent in cases of mild infection.

The apricot necrosis herein described is not the same as the branch die-back ('Zweigsterben' or 'Zweigkrebs') due to *S. laxa* reported from Germany [ibid., xxi, p. 460], which is characterized by repeated destruction and re-formation of wound tissue. It also differs from the 'cankers' observed by Wormald in England as a symptom of *S. laxa* [ibid., xiv, p. 367], the German equivalent for which is 'Rindenbrand'.

Willison (R. S.), Berkeley (G. H.), & Chamberlain (G. C.). **Yellows and necrotic ring spot of sour Cherries in Ontario—distribution and spread.**—*Phytopathology*, xxxviii, 10, pp. 776–792, 2 diags., 2 graphs, 1948.

For three or more consecutive years since 1941, one Montmorency cherry orchard in Ontario has been under observation for cherry yellows virus alone, two for necrotic ring spot alone [*R.A.M.*, xxvi, p. 203], and three for both diseases, while the distribution of the yellows was mapped in a further five orchards for the first time in 1945. The problem is complicated by the tendency of necrotic ring spot to become masked in course of time. Analysis of the data indicates that a higher percentage of trees is likely to be infected by necrotic ring spot than by yellows when an orchard is set out; that rates of spread are largely determined by initial incidence and by the relative position of diseased and 'healthy' (including suspected) trees at planting; and that little fundamental difference in the rates and

mode of spread of the two viruses can be expected even where apparent disparities are considerable. The yellows virus is apt to spread more frequently to adjacent trees than to those at a distance, and its dissemination appears to depend to some extent on prevailing winds. Possibly the virus may be conveyed from one tree to another mainly by an insect vector which only rarely moves from one tree to another, and then only under the influence of air currents.

In all the orchards surveyed, some trees showed symptoms of only one disease, others of both, while others again were apparently healthy. Since yellows symptoms develop annually and those of necrotic ring spot may be masked, trees showing only the latter may be presumed free from yellows, whereas those with symptoms only of yellows may also harbour necrotic ring spot. In cases of known infection by both viruses, necrotic ring spot commonly preceded yellows, but sometimes the two appeared simultaneously or yellows was observed first.

Adam (W. B.), Dowson (W. M.), & Marsh (R. W.). **Effect of organic spray residues on canned Blackcurrants. II.**—*Rep. agric. hort. Res. Sta. Bristol, 1947*, pp. 163–171, [? 1948].

The results of further experiments conducted in 1946 and 1947 on the control of *Pseudopeziza ribis* on Baldwin black currants [*R.A.M.*, xxv, p. 2] indicated that the pathogen was controlled by four applications of tetramethylthiuram disulphide (4:100) or zinc dimethyldithiocarbamate ($2\frac{1}{2}$:100) in both years, while fermate (2:100) was effective in 1946 and dithane D 14 plus zinc sulphate and lime ($\frac{1}{2}$:1:$\frac{1}{2}$:100), heptadecyl glyoxalidine 341 (1:100), and phygon (1:100) in 1947, all receiving one trial only. Their residues, however, stimulated hydrogen production in the cans even at very low concentrations, and the flavour may be adversely affected. This only applies to whole currants canned as dessert fruit, and not to pre-heated pulp. Heptadecyl glyoxalidine caused no adverse corrosive or flavouring effects and further tests with this spray are recommended. [This paper also appears in *Rep. Fruit Veg. Pres. Sta., Campden, 1947*.]

Horn (N. L.). **A new virus disease of Blackberry.**—*Phytopathology*, xxxviii, 10, pp. 827–830, 2 figs., 1948.

In 1942 a single strikingly variegated wild blackberry (probably *Rubus alleghensis*) was observed in a raspberry-growing district of Maryland, and in 1947 a portion of it was removed to the greenhouse for further study. An examination during this season of all blackberry plants within a 200-yard radius revealed none with such extensive variegations, but there were ten with a few sharply defined, bright-yellow areas, 0·3 to 1 cm., on one or more leaves. Grafting experiments between diseased blackberries and (*a*) healthy blackberries and (*b*) Cumberland × Evans hybrid raspberries were successful: six out of ten plants (four raspberries and two blackberries) developed the above-mentioned symptoms, which in five appeared within 30, and in one 73 days after the grafts were made. In all the infected raspberry plants the first symptoms were observed about 2 ft. distal to the graft, and the chlorosis then extended progressively towards the growing-point. On the other hand, in one of the blackberries the yellow areas first appeared on a single leaflet immediately below the graft and then spread to the adjoining leaves in both directions. In two cases the virus was graft-transmitted from artificially infected raspberry to healthy blackberry without change in the induced symptoms.

The features of the wild blackberry disease varied considerably in individual raspberry and blackberry leaflets, some of which contained only a few white islands while others were almost entirely white. The infected areas of young leaves of both plants are pale green at first, later turning yellow, and becoming nearly white with advancing maturity.

Transmission in over half the grafting experiments and the type of symptoms induced indicate that the causal organism is an apparently new virus, which may be of potential importance in view of its location in a raspberry-growing district.

Kronenberg (Hester G.), Gerritsen (J. D.), Klinkenberg (Caroline H.), Erkelens (M. A.), & Zweede (A. K.). **De Aardbei.** [The Strawberry.]—xii+327 pp., 102 figs., 14 diags., 2 graphs, W. E. J. Tjeenk Willink, Zwolle, Holland, 1949.

This useful monograph contains a chapter by Dr. C. H. Klinkenberg, describing the most important pests and diseases of the strawberry. The occurrence of black root [*R.A.M.*, xi, p. 251] (attributed to a fungus complex including *Coniothyrium fuckelii*, *Cylindrocarpon radicicola*, *Hainesia* [*Pezizella*] *lythri*, *Pachybasium candidum*, *Ramularia* sp., *Rhizoctonia* sp., and *Verticillium* sp. [cf. ibid., xviii, p. 809; xxviii, p. 21]) is believed to be coextensive with the cultivation of the crop.

A disease known in the Kennemerland district of Holland as 'canker' has not yet been fully investigated. It is characterized by the appearance in the field, mostly in the second or third year of growth, of patches of varying extent occupied by stunted plants. In succeeding years these patches extend and the plants in the centre disappear altogether. The young leaves of the dwarfed plants are small, short-stalked, of a dull, yellowish-green colour with a bronze cast, or occasionally bluish-green, and sometimes crinkled. A distinct yellowing of the leaf margins, sometimes apparent in the summer, is very reminiscent of yellow edge virus [ibid., xxvi, p. 346], but there are two important differences. In the first place, the marginal yellowing of cankered plants develops in the summer, when the discolorations associated with yellow edge are absent, while conversely, when the latter appear in the autumn, the leaf margins of the cankered plants are no longer chlorotic. Secondly, the canker symptoms also occur on varieties tolerant of yellow edge, such as Frau Mieze Schindler. The diseased plants produce few or no runners, give poor yields, and the taste of the fruits is disagreeable. The root system presents the typical features of black root rot, while a few, mostly minute protuberances of the eelworm, *Pratylenchus pratensis*, are often present. Infection may persist in the soil for years, regardless of deep digging. All the local varieties are susceptible, Anna Paulowna somewhat less so than the rest. Presumably the canker is a form of black root rot, with the possible intervention of other factors.

Other diseases affecting strawberries in Holland are mildew (*Sphaerotheca humuli*), fruit rots, including grey mould (*Botrytis cinerea*), the virus diseases yellow edge, crinkle, and witches' broom [loc. cit.], and various physiogenic disturbances due to adverse meteorological conditions, hereditary defects, and mineral deficiencies.

Tims (E. C.) & Olive (L. S.). **Two interesting leaf spots of Fig.**—*Phytopathology*, xxxviii, 9, pp. 707–715, 2 figs., 1948.

Two very conspicuous leaf spots, of closely similar general appearance, were observed on figs in southern Louisiana in September, 1939. One of these, already reported under the name of '*Cephalosporium* leaf spot' and tentatively ascribed to *C. acremonium* [*R.A.M.*, xxi, p. 31], recurred in a more severe form on the Celeste variety in 1942. The spots produced by this fungus, herein designated *C. fici* n.sp., were distinguishable by the presence on the lower leaf surface of cottony, white tufts, while those of the second organism, *Ormathodium fici* n.sp., were characterized by a smoky, greyish-brown central growth surrounded by a border of white mycelium. The *C. fici* lesions measure 1 to 6 and those of *O. fici* 1 to 8 mm. in diameter.

The hyaline intercellular mycelium of *C. fici* gives rise through the stomata to an external mycelium, the hyphae of which climb the leaf hairs and congregate along the upper portions of the trichomes to produce compact cords, 250 to 400 by

18 to 55 μ. The phialides arising directly from the cords or from short lateral branches are uni- to biseptate or non-septate above and measure 34 to 99 by 2·4 to 4 μ. The oval to cylindrical, straight to slightly curved, unicellular, hyaline conidia produced singly at the tips of the phialides measure 3·8 to 10·4 by 1·9 to 4·5 (average 6 by 3) μ, but they aggregate into globose masses, 6·9 to 12·2 μ in diameter.

The fungus made good growth and sporulated freely on several standard media. It was successfully inoculated into mature fig leaves by spraying with spore suspensions or by the application to the lower leaf surface of fragments of a bean pod culture. Under the warm, humid conditions prevailing in July and August, symptoms developed on the inoculated leaves in four to six days, and the rapidly expanding spots attained a diameter of 3 to 5 cm. within a fortnight. Their centres often fell out, leaving ragged, irregular holes similar to those observed on naturally infected leaves. The white fructifications of the fungus were detected on the lower leaf surface within a week after infection, and spore dilutions from this material yielded pure cultures of *C. fici*. Old diseased foliage on the ground is probably the primary source of infection, the earliest symptoms being invariably observed on the basal leaves. In the early summer of 1940 inoculations on a small group of trees resulted in infection which spread to other trees in the neighbourhood, and by the following summer the entire group had become infected.

The spots produced by *O. fici* may comprise from two to 12 concentric rings, light to very dark brown on the periphery and turning papery-white towards the centre, which often falls out, leaving a ragged hole. The light brownish external mycelium, 2 to 4·5 μ in diameter, like that of *C. fici*, develops through the stomata from the intercellular mycelium, and gives rise to smoky-grey to brownish, branched, multiseptate, semi-erect conidiophores, 135 to 240 by 3 to 4 μ, in the centres of the lower surfaces of the spots, where they twine round the leaf hairs; the cylindrical or clavate, straight or curved, smoky-grey to brownish, smooth or occasionally minutely verrucose conidia with one to five, mostly three, rarely seven septa, 13·9 to 29·6 by 3·4 to 5·2 μ, are formed singly or in series of two to three at the apices of the conidiophores and laterally on prominent nodes; they are furnished with a minute hilum at the proximal end and produce a germ-tube from any cell.

The fungus made slow growth on agar media, the light to dark brown colonies reaching a diameter of only 5 cm. after 38 days on oatmeal agar at 28° to 32° C.: at 22° to 25° they developed rather more rapidly. Some sporulation occurred on water agar plates, but in general few conidia were produced in culture. Positive results were obtained in inoculation experiments on the lower leaf surfaces, and typical spots developed after ten days to a fortnight. The fungus was reisolated from the lesions.

The genus *Ormathodium* was established by Sydow in 1928 [*Ann. mycol., Berl.*, xxvi, p. 138] to accommodate a *Dendryphium*-like parasitic fungus. However, as one of the authors has recently pointed out [*R.A.M.*, xxvii, p. 450], *Dendryphium* consists almost exclusively of saprophytic species, whereas *Ormathodium* is a well-marked parasite. In this respect it also differs from the otherwise similar *Dendryphiella*.

Mason (C. L.). **A study of the fungicidal action of 8-quinolinol and some of its derivatives.**—*Phytopathology*, xxxviii, 9, pp. 740–751, 1 diag., 4 graphs, 1948.

Fungicidal tests of 8-quinolinol and 11 of its derivatives were performed by the settling tower and spore-dilution drop methods [*R.A.M.*, xxvii, p. 32]. All the metallic salts of 8-quinolinol except the copper produced a two-peaked curve in their effect on spore germination in *Stemphylium sarciniforme*. The substitution of chlorine or bromine atoms for hydrogen in the 5 and 7 positions reduced the toxicity of 8-quinolinol, while the substitution of nitro groups in the same positions entirely eliminated it. Copper 8-quinolinolate proved superior to Bordeaux mixture in the

reduction of spore germination in *S. sarciniforme*. The conversion of concentrations from parts per million to molarity did not prevent the wide variations in strength of compounds with different molecular weights necessary to reduce or inhibit the germination of *S. sarciniforme* spores. The compounds of this group which at some point permitted no sporulation, viz., 8-quinolinol, the copper salt, the halogenated derivatives and their copper salts, and 8-quinolinol sulphate, were found to be fungicidal rather than fungistatic.

The following conclusions may be drawn from the results of these studies. The compounds tested did not, like most others, produce a straight-line dosage-response curve, a fact which casts doubt on the value of LD 50 as an index of comparison between different fungicides, unless the entire dosage-response curve from LD 0 to LD 100 has been determined.

The precipitation of the heavy metals by 8-quinolinol, so that they are no longer available to the test organism, does not entirely account for the toxic action of the compound and its derivatives used in these experiments.

The substitution of chlorine and bromine for hydrogen atoms in the 5 and 7 positions did not enhance the toxicity of 8-quinolinol, as has been reported for halogen substitutions in some phenol compounds [ibid., xiv, p. 105].

Copper 8-quinolinolate proved to be the most efficient fungicide among the compounds tested, besides possessing many of the properties desirable in a plant-protective [ibid., xxvi, p. 67].

Watkins (G. M.) & Klemme (Dorothea E.). **Some effects of dextrose concentration upon the action of a fungicide, 2,2′-methylenebis (4-chlorophenol).**—*Amer. J. Bot.*, xxxv, 9, pp. 622–627, 4 graphs, 1948.

The effects of dextrose level in nutrient solutions on the response of two isolates of *Aspergillus niger* to concentrations of up to 60 p.p.m. of the fungicide 2,2′-methylenebis (4-chlorophenol) [*R.A.M.*, xxvii, p. 41] were studied at the United States Naval Ordnance Laboratory, Maryland. With dextrose at under 2 per cent., regularly increased fungicide concentrations resulted in progressively decreased growth. Above 2 per cent. the lower fungicide levels, especially from 10 to 30 p.p.m., often allowed growth equal to or exceeding that of the corresponding controls. With a given fungicide concentration the ratio of growth with and without fungicide increased steadily with the rise in dextrose level; at 40 p.p.m. of the fungicide this ratio increased from 0 at 0·5 per cent. dextrose to 0·88 at 8 per cent. With excess dextrose lower concentrations of the fungicide extended the total growth period, as compared with the controls.

Stark (F. L.). **Investigations of chloropicrin as a soil fumigant.**—*Mem. Cornell agric. Exp. Sta.* 278, 61 pp., 2 figs., 11 graphs, 1948.

In greenhouse and laboratory studies on the use of chloropicrin as a soil fumigant [cf. *R.A.M.*, xv, p. 518; xxiv, p. 493; xxv, p. 544; xxvii, p. 155] and its physical effects on soil properties, the author determined the effect of various concentrations of chloropicrin-water solutions upon agar cultures of 43 species of fungi. Most soil-borne pathogenic fungi (except those which form sclerotia) were highly susceptible to the fumigant, while several non-pathogenic moulds, particularly Mucorales, were very resistant.

Laboratory fumigations demonstrated that increase in the temperature or the moisture content of seeds and fungi also increased the lethal effect of the fumigant. Most fungi were very resistant in a dry, and very susceptible in a humid, atmosphere. The evidence obtained indicated that the action exercised by humidity results from its effect on both the moisture content and permeability of the seed coat and also on the moisture content of the organisms and their metabolic processes.

Several experiments indicated that the soil surface is generally less effectively fumigated than are the lower levels. Maximum kill occurred at the level at which the chloropicrin was injected. Low moisture content (10 to 15 per cent. of the water holding capacity) and high temperature were most favourable regardless of soil texture. Fumigation was most effective in soils containing the largest proportion of sand. Sealing the surface with water immediately after application of the fumigant was beneficial in all conditions, particularly with porous soils.

Parr (H. C. M.) & Busvine (J. R.). **A spinning-disk sprayer for applying residual insecticides.**—*Ann. appl. Biol.*, xxxv, 3, pp. 359–368, 3 figs., 2 graphs, 1948.

Details are given of the construction and performance of an apparatus developed at the London School of Hygiene and Tropical Medicine for applying residual insecticides to various surfaces up to 1 ft. square. The spray is produced by feeding the liquid on to the centre of a fast-spinning horizontal disk. The liquid picks up the rotary velocity of the disk and spreads outward under the influence of centrifugal force. It is then projected from the periphery in the form of droplets of the same order of size (about 0·1 to 0·4 mm. in diameter) as those produced by a knapsack sprayer but more uniform and consistent. The spray deposits can be controlled and estimated with a fair degree of accuracy.

Frear (D. E. H.). **A catalogue of insecticides and fungicides. Volume II. Chemical fungicides and plant insecticides.**—xii+154 pp., 5 figs., Waltham, Mass., The Chronica Botanica Co.; London, W.C. 2, W. Dawson & Sons, Ltd., 1948. Price $5.50.

In this second volume of the present valuable compilation, the system of code numbers used in the first [*R.A.M.*, xxvii, p. 286] is given again and the same arrangement followed. It comprises chemical fungicides, condensation products, fungicides from plant products, miscellaneous fungicides, insecticides from plants, miscellaneous plant products, references and author index, a numerical patent list, and an index of the chemical compounds in both volumes. It has been the author's aim to bring together all, or nearly all, the published results on tested materials up to January, 1944.

Steyaert (R. L.). **La situation phytosanitaire de l'Afrique centrale.** [Plant health in central Africa.]—*Parasitica*, iv, 3, pp. 109–130, 1948.

The author discusses at length the state of plant health in central Africa, reviews the problems, and sets out the conclusions to be drawn regarding the general policy to be adopted for the control of diseases caused by fungi, insects, and viruses.

Magrou (J.). **Les maladies des végétaux.** [The diseases of plants.]—374 pp., 134 figs., 1 graph, [Paris], L'Expansion Scientifique Française, [? 1948].

The aspect of phytopathology principally considered by the author in this manual is the mechanism of parasitic action and the host responses to the stimulus thereby induced. Hence considerable attention is directed towards the phenomena of symbiosis and immunity (chapters VIII and X). No attempt has been made to give complete descriptions of the various diseases, but merely to formulate some principles of general biology based on the more important and significant pathological data emerging from a critical scrutiny. The other chapters are concerned with (I) general characters of the fungi; (II), (III), and (IV) plant diseases due to fungi; (V) plant diseases due to bacteria; (VI) plant diseases due to protozoa; (VII) plant diseases due to viruses; and (IX) animal galls. Each chapter is furnished with a bibliography of the literature consulted.

Wenzl (H.). **Die Krankheitsabwehr der Pflanze.** [The defence of the plant against disease.]—*Jb. Hochsch. Bodenkult., Wien*, i, 2. Teil, pp. 111–122, 1947.

This is a general discussion of some leading contributions to the knowledge of the mechanism of defence against disease in plants [cf. *R.A.M.*, xxvi, pp. 22, 134, *et passim*].

Bawden (F. C.). **Plant diseases.**—x+206 pp., 30 pl., London & Edinburgh, Thomas Nelson & Sons, Ltd., 1948. 7*s.* 6*d.*

The author maintains that many of the crop losses caused by plant diseases could be avoided by the application of existing knowledge, and in this useful manual the general principles of the subject and the available information concerning it are presented in a concise and readable form. Chapter (I) deals with the causes of disease in plants, (II), (III), and (IV) with seed-borne, soil-borne, and air- and insect-borne diseases, respectively; (V) with the alternate and alternative host; (VI) with physiological diseases; (VII) with the influence of environment on infectious diseases; (VIII) with genetics and plant diseases; and (IX) with the control of plant diseases.

Moore (W. C.). **Mycology and plant pathology.**—*Trans. Brit. mycol. Soc.*, xxx, pp. 64–66, 1948.

In England, no clear distinction has yet been made between mycology and plant pathology, because the study of plant diseases has, until recently, been dominated by research on pathogenic fungi.

In the author's view, mycology comprises many things, including the taxonomy of fungi, their collection and preservation, their biology and nutrition, their uses in medicine and industry, and the part they play in diseases of plants, animals, insects, and man. Plant pathology treats of plants, their nature, cause, progress, and results; it is concerned with the pathological condition of plants, whatever its origin. The subject should, therefore, be regarded as comprising the study of plant diseases caused by fungi, algae, bacteria, viruses, and eelworms, the study of plant pests, and that of nutritional or physiological disorders.

These two subjects overlap, strictly speaking, only where each is concerned with plant pathogenic fungi. Hitherto, the overlap has been unduly large in England, since fungi as agents of disease have received chief attention in both fields, but this predominance is likely to become less obvious in future. The greater attention now paid to virus diseases and nutritional disorders has already shifted the emphasis in plant pathology, and the same thing will happen in mycology, when research in systematic, industrial, and medical mycology is given the attention it deserves.

Ramsbottom (J.). **Presidential address.**—*Trans. Brit. mycol. Soc.*, xxx, pp. 22–39, 1948.

In this address, delivered at the fiftieth anniversary meeting of the British Mycological Society (held in London, 20th to 25th October, 1946), the author after an introductory survey of mycology prior to 1896 reviews and discusses some of the chief advances made in mycology during the last fifty years. Subjects dealt with include the publication of Saccardo's *Sylloge Fungorum*, the significance to diagnosis of spore measurements and cystidia, and the cytology of fungi which should give valuable help to mycology. It is suggested that more attention might be paid to fungal diseases of native plants.

Doyer (Lucie C.) **Several seed-borne fungus diseases and methods for identifying them in seed testing.**—*Trans. Brit. mycol. Soc.*, xxx, pp. 67–73, 1948.

The author outlines the methods used in identifying seed-borne fungus diseases at the Seed Testing Station, Wageningen [*R.A.M.*, xviii, p. 265] and discusses the features of the chief diseases of this kind that occur in Holland. The paper concludes with a plea for international co-operation in seed-testing.

Muskett (A. E.). **Technique for the examination of seeds for the presence of seed-borne fungi.**—*Trans. Brit. mycol. Soc.*, xxx, pp. 74–83, 3 pl., 1948.

The methods of seed-testing for the presence of seed-borne fungal pathogens as practised in Northern Ireland are described. That previously used for determining the effect of seed disinfectants on *Helminthosporium* disease of oats (*H.* [*Pyrenophora*] *avenae*) [*R.A.M.*, xvii, p. 810; xxiv, p. 95], has been adopted for seed-testing.

No method tested for the examination of flax seed for fungal infection was found to be as simple and easy as the Ulster method [ibid., xx, p. 261], which allows ready detection (on or in the seed) of *Colletotrichum linicola*, *Polyspora lini*, *Botrytis cinerea*, *Phoma* sp., and *Fusarium lini* [ibid., xxvi, p. 56]. Over 20,000 samples of flax seed have been examined by this method in the last six years in Northern Ireland. Usually a glance at both sides of the colonies in the test dish and a rapid inspection by transmitted light suffices for examination. *Pullularia pullulans* and *Polyspora lini* may easily be distinguished by such an inspection.

In examining perennial rye grass [*Lolium perenne*] seed for *Phialea temulenta* [ibid., xxvii, pp. 116, 284] each seed is placed in a drop of water on a clean glass slide; one or both glumes are removed, and the identity of the macrospores which float out in large numbers is checked by microscopic examination. If evidence of viability is needed the method of Neill and Hyde for isolating the fungus [cf. ibid., xviii, p. 601] can be used. The caryopses, after immersion in 0·1 per cent. mercuric chloride for ten minutes followed by washing in sterile water, are bisected longitudinally, and plated out on 2 per cent. malt extract agar. If the fungus is viable, recognizable colonies showing abundant macrospore production will be observed after incubation at 22° C. for seven to 12 days, according to the age of the seed.

The author considers that the development of suitable testing techniques that are simple, rapid, and inexpensive will simplify the problem of ensuring the health, not only of the seed, but of all propagating material. The need for seed surveys on both a national and an international scale, from the standpoint of seed health, is essential, and the carrying out of such surveys appears to be a necessary prelude to the routine examination of seed supplies. Routine flax seed testing in Northern Ireland [ibid., xxvi, p. 56] has shown that unless a number of very favourable seasons recur in succession, the build-up of parasitic fungi increases with repeated sowings of seed from the same stocks. For this reason the climate of the north and west of Britain is unsuited to flax seed production. The purity of all the seed examined, although often contaminated with fungi, was of a very high order, and in every case the germination capacity was over 90 per cent.; in view of this, the significance of seed health as a factor which is not determined by routine seed-testing methods becomes apparent. In accordance with present legislation every one of these samples would be accepted as seed of the first quality.

Loest (F. C.). **Plant diseases and cultural operations.**—*Fmg S. Afr.*, xxiii, 266, pp. 304–307, 324, 1948.

In this paper the author reviews cultural practices in the light of the relationship between disease incidence and incorrect operations [cf. *R.A.M.*, xxvii, p. 576]. The importance of using certified or disinfected crop seeds and disinfected potato tubers is emphasized, the increased cost of which is comparatively negligible. The diseases

resulting from thick seed sowing, incorrect seed-bed structure and sanitation, and the use of infective compost are surveyed. Wider spacing of tomato plants help in the control of *Septoria* leaf spot [*S. lycopersici*], early blight [*Alternaria solani*], and *Phytophthora parasitica*, four to six feet between rows and one to one and a half feet between individual tomato plants should be adopted in unstaked commercial plantings. It is advisable to set out citrus trees and carnation plants as high as possible to prevent infection through the soil by *P. citrophthora* and *Corticium solani*, respectively, and tomato seedlings as low as possible to prevent *A. solani* lesions forming on the stems. Diseases which occur in the Transvaal Lowveld through planting out of season include *Xanthomonas solanacearum* on potato and tomato, *Fusarium* wilt of tomatoes [*F. bulbigenum* var. *lycopersici*], peas [*F.* spp.], and cucumbers [*F. bulbigenum* var. *niveum*], cabbage black rot [*X. campestris*], and bean bacterial blight [*X. phaseoli*]. The pathological consequences of mechanical and climatic injury to citrus fruit, papaws, and sweet potato tubers are reviewed. Serious damage from *Gloeosporium papayae* can be avoided by judicious irrigation and fertilization of papaw trees suffering severe hail or frost damage. To prevent sunburn of the trunk and branches of avocado pear and subsequent attack by *Colletotrichum gloeosporioides* [*Glomerella cingulata*] and *Melanops* [*Physalospora*] *perseae*, the trunks and main limbs should be thoroughly and repeatedly white-washed following hail or frost injury until sufficient foliage is produced to shade the affected areas. Tomato plants, if not too severely damaged by frost or hail, can be returned to a state of profitable production by a top-dressing of a nitrogenous fertilizer and dusting with a fungicide to prevent attack by *S. lycopersici* and *A. solani*.

Gregory (P. H.). **The multiple-infection transformation.**—*Ann. appl. Biol.*, xxxv, 3, pp. 412–417, 1 graph, 1948.

Attention is drawn to the possibility of misinterpreting results which may arise when the incidence of an organism, a disease or parasite on a crop, or any other event is expressed in either of the two standard ways, i.e., as the number of organisms, lesions, etc., per unit area or as the percentage of unit areas 'infected' irrespective of the number of organisms which have brought about the infection. For plant diseases the unit chosen may be a measured area, but is more often an organ such as a leaf, or even a whole plant. For convenience the unit in this paper will be called a plot. It is necessary to apply the conversion previously termed 'Thompson's transformation' [*R.A.M.*, xxiv, p. 378] to the data to avoid aberrant results when percentage data are used in the study of plant disease gradients to infer variations of spore density or numbers of aphis punctures. The need for transformation is illustrated by considering the case of 100 uniformly susceptible potato plants, exposed to infection by *Phytophthora infestans* from a distant source. The first infecting spore must obviously colonize 1 per cent. of the plants. A second infection, as long as it falls at random among the 100 plants, will have one chance in 100 of alighting on the plant already infected, instead of infecting a second. As the percentage of infected plants rises, the probability that each additional infection falls on a plant already infected, thus producing no increases in the percentage of plants infected, increases greatly. When 99 per cent. of the plants are infected, another infection will have only one chance in 100 of falling on the single remaining healthy plant. Different parts of the percentage range, therefore, correspond to very different spore densities per unit area, and the transformation can be neglected only in the lower percentage categories. As shown by a transformation table for determining the number of infections from the percentage of plants infected, while only one infection is required to increase infection from 1 to 2 per cent., the increase from 98 to 99 per cent. requires 69 infections (460—391). The reason for making this transformation arises from the fact that one would expect to find the rules relating

the dispersion of an organism with distance simpler if actual numbers were used in place of percentages.

The gradient of percentage infection at increasing distances from the infection source may be much flatter than the corresponding gradient of the relative densities of spores at these distances when calculated from the multiple infection transformation. The amount of flattening depends on the incidence of the disease and the size of plot chosen. Examples are given of leaf diseases (*a*) distributed at random (*Phytophthora infestans* on potato) and (*b*) aggregated (*Gymnosporangium juniperi-virginianae* on apple and *G. clavariiforme* on *Crataegus monogyna*). In the case of the first-named the distribution is close to the expected random distribution but for the second distribution differs widely from the random arrangement, the rust lesions showing very strong aggregation on the apple leaves at the higher levels of infection. Agreement was better at lower levels. Methods of detecting and measuring aggregation are briefly discussed.

Jørgensen (A.). **Micro-organisms and fermentation. Fifteenth Edition.**—550 pp., 37 pl., 42 figs., 7 diags., 2 graphs, London, Charles Griffin & Co., Ltd., 1948. 60*s*.

The present edition of the late Alfred Jørgensen's treatise on the micro-organisms of the fermentation industry [cf. *R.A.M.*, xviii, p. 809] has been entirely rewritten and brought up to date by A. Hansen. This exhaustive work, supplemented by a bibliography and subject-index, has been undertaken with a special view to the teaching of fermentation and technical bacteriology at the Alfred Jørgensen Laboratory of Fermentology, Copenhagen, but it is also intended as a book of reference for those engaged on the practical side of the fermentation and foodstuff industries, dairying, and the like. The book comprises the following chapters: (I) general features of the development of fermentology up to about the year 1900; (II) arrangement and equipment of the laboratory of fermentology; (III) fermentation organisms in general; (IV) nutrient media; (V) sterilization and disinfection; (VI) technique; (VII) moulds; (VIII) yeast and yeast-like organisms; and (IX) bacteria. An appendix deals with nutrient media and reagents.

James (N.) & Smith (K. N.). **Studies on the microflora of flour.**—*Canad. J. Res.*, Sect. C, xxvi, 5, pp. 479–485, 1948.

A study of the micro-organisms present in fifty samples of ordinary Canadian flour [cf. *R.A.M.*, xxvi, p. 409], representing five brands milled by one company and designated 1 to 5, respectively, showed that at 25° C. brand 1 averaged 2,750 bacteria per gm. per 10 samples on nutrient agar, 2,010 on bromo-cresol-purple dextrose tryptone agar, 1,150 fungi on Czapek's agar, and 1,270 on malt salt agar. Bacteria and fungi were the major groups of organisms in all five brands. The numbers of these organisms showed the same trend in relation to brands and the difference between brands was significant. Thus, for brands 2 to 5 the corresponding figures for bacteria on nutrient agar at 25° were, respectively, 7,980, 17,630, 12,900, and 19,500 per gm. and for fungi on malt salt agar 1,140, 3,510, 2,630, and 3,960.

Cook (C. D.) & Harrington (R.). **Fungicide for cork.**—*Prod. Engng*, xix, 6, p. 107, 1948.

Tests were conducted at the General Electric Company, Schenectady, New York, to determine the relative merits of beta-naphthol and salicylanilide for the protection of high-grade, soft, pressed, phenolic-cemented sheet cork against infection by *Chaetomium globosum*, *Penicillium luteum*, *P.* sp., *Aspergillus niger*, *Trichoderma* sp., and *Fusarium* sp. [cf. *R.A.M.*, x, p. 328]. After inoculation the samples were placed in an atmosphere with a relative humidity of 95 per cent. and a temperature of 35° C.

After a fortnight the fungicidal properties of both compounds, especially beta-naphthol, were found to have been impaired by heat-ageing, long, low heat being more deleterious than short periods of high heat. At the end of a further two months the samples treated with 5 per cent. salicylanilide, which had shown no fungal growth after the first fortnight, were still free from infection. Salicylanilide was shown by tests in which treated samples were placed in contact with strips of various metals to be non-corrosive.

White (W. L.), Siu (R. G. H.), & Reese (E. T.). **The black Aspergilli in relation to cellulosic substrata.**—*Bull. Torrey bot. Cl.*, lxxv, 6, pp. 604–632, 10 figs., 1 graph, 1948.

This paper supplements the results of tests, carried out at the United States Army Quartermaster Corps Laboratory, with 52 isolates belonging to the black group of *Aspergillus* species commonly designated the *A. niger* group [*R.A.M.*, xxvii, p. 486]. They indicated that cellulolytic ability is absent from the *A. niger* and *A. carbonarius* series, but is a moderately constant feature of the *A. luchuensis* series. Of 12 strains of this series (none identified specifically) isolated from military fabrics, nine gave positive results, one was weak or doubtful, and two were negative. Named cultures of *A. luchuensis* and *A. violaceo-fuscus* were inactive, while one of *A. japonicus* was strongly active and another weak or doubtful. Further investigation of cellulolytic activity in relation to the current species concepts within the *A. luchuensis* series would appear to be desirable.

These conclusions are based on decline in tensile strength of strips of cotton fabric. Members of the *A. luchuensis* series which were inactive on strips of bleached cotton sheeting partially immersed in a mineral salts solution readily attacked the sheeting when strips of less highly purified grey duck were placed next to them, the indication being that the nutrition of these fungi is not of the simplest type.

In field conditions, fungi belonging to the black group of *Aspergillus* have been found in a sporulating condition only on light-weight heavily sized fabrics, usually in storage or transit. They often occur in isolations from tentage and other heavy size-free military fabrics, but there is no evidence that they are present except as spores. In field conditions, however, these fungi may, possibly, through constant spore germination and slight vegetative growth, effect damage to fungicidal and other finishing treatments which may, in the aggregate, cause considerable economic loss.

When the nutrition and fungicidal tolerance of strains of the *A. luchuensis* group have been determined the species may prove useful in assessment testing for mould-proofness of cellulosic materials.

Meeuse (A. D. J.). **Textiles: protection against attack by micro-organisms.**—*Meded. Vezelinst. T.N.O.* 85, 54 pp., 1947. [Dutch. Abs. in *J. Text. Inst., Manchr*, xxxix, 8, p. A 375, 1948.]

In the light of a survey of recent literature, comprising 103 references, on the microbiological degradation of textile materials, various factors affecting the growth of the organisms concerned, e.g., moisture, temperature, nature of the fabric, and service conditions, are discussed. Methods of protection against microbiological infection are reviewed, especially preservative treatments. The requirements for an ideal preservative are enumerated and the properties, merits, and drawbacks of existing commercial fungicides and bactericides for textile fabrics are considered. Methods for the determination of the extent of microbiological damage and the efficiency of preservatives are compared. Attention is drawn to the discrepancies in the results frequently obtained by the various methods, necessitating the careful choice of a procedure applicable to the aim of the particular investigation in hand. On account of their probably greater reproducibility, pure cultures of

individual micro-organisms are regarded as superior to natural infection for test purposes.

Birkinshaw (J. H.). **Some aspects of fungal metabolism; with particular reference to the production of antibiotics.**—*Trans. Brit. mycol. Soc.*, xxx, pp. 50–63, 7 figs., 1948.

After a brief reference to the early history of the study of the metabolic products of fungi the author reviews and discusses the work done in the last 25 years by Professor Raistrick and fellow-workers and recent work on penicillin, streptomycin, and other antibiotic products, a useful, tabulated summary of which is given. As a result of studies in many different countries a large number of fungal metabolic products have now been described, and the author selects some of these to indicate the type of pattern which is gradually being revealed and which, in time, may allow a composite picture of fungal metabolism to be presented. He discusses the groups showing anabolic powers, including citric acid and its derivatives and the tetronic acid series.

Chain (E.). **Chemical properties and structure of the penicillins.**—*Endeavour*, vii, 27, pp. 83–91; 28, pp. 152–158, 1 fig., 1948.

In these articles the author gives information based on nearly 700 chemical reports prepared during the Anglo-American research on penicillin during and since the recent war, describes the research which led to the final elucidation of the structure of the penicillin molecule, and discusses attempts to synthesize penicillin either partially or completely.

Melin (E.). **Recent advances in the study of tree mycorrhiza.**—*Trans. Brit. mycol. Soc.*, xxx, pp. 92–99, 1948.

The author reviews and discusses the results of studies carried out by workers in various countries during recent years upon the mycorrhiza of forest trees, with special reference to his own investigations in Sweden [cf. *R.A.M.*, xxi, p. 390; xxv, p. 518]. He concludes that the available evidence demonstrates indisputably that tree mycorrhiza are, under certain conditions, more effective as nutriment-absorbing organs than are the roots alone. In forest soils deficient in nitrogen or phosphorus or both, mycorrhizal fungi can compete with soil micro-organisms for nourishment more successfully than tree roots. It would seem, however, that different species of mycorrhizal fungi are not equally effective in their contribution to the nourishment of the trees. Different mycorrhizal combinations are probably not physiologically equivalent. It will be an important task for future research to compare from a tropho-physiological standpoint various combinations of mycorrhiza on one and the same tree.

Armstrong (G. M.) & Armstrong (Joanne K.). **Non-susceptible hosts as carriers of wilt Fusaria.**—*Phytopathology*, xxxviii, 10, pp. 808–826, 1948.

In studies at the South Carolina Agricultural Experiment Station on the function of non-susceptible hosts as carriers of wilt-inducing species of *Fusarium*, the plants were grown in soil, in solution-culture, and in steamed sand. The inoculation procedures in soil, using a wheat-oats mixture [*R.A.M.*, xix, p. 592] and in solution-culture [ibid., xx, p. 531] have already been described. For the steamed sand cultures, the plants were grown in 2-gal. glazed pots with a 2-cm. hole laterally at the bottom for drainage and inoculated either by (A) pouring a three-day-old solution culture of the fungus into holes made round the plant base, or (B) dipping the roots of young plants, grown in sterilized soil and washed, in the inoculum and immediately transferring them to a pot of sand. A second inoculation was made a week or more later by the former method if no symptoms of wilt had developed by

that time. Method A is essentially the same as W. H. Thorp's (personal communication), while B is a modification of that described by Wellman [ibid., xix, p. 170].

Healthy sweet potato roots were shown to carry internally species of *Fusarium* of the section *Elegans* differing from those causing wilt of that host (*F. oxysporum* f. *batatas*) [*F. oxysporum* f. 2: ibid., xxiii, p. 209]. Plants from these roots also contained *Fusarium* spp., presumably originating in the parent sweet potato. Cotton, either inoculated in the greenhouse or grown in a field infested by *F. oxysporum* f. 2, was invaded by this fungus without showing any symptoms of wilt and thus served as a carrier. Other symptomless carriers were *Cassia tora*, Mexican clover (*Richardia scabra*) (a weed growing among wilting sweet potatoes in a field), okra [*Hibiscus esculentus*], sage, soy-bean, and tomato, from all of which *F. oxysporum* f. 2 was reisolated and successfully inoculated into sweet potato. A *Fusarium* causing tobacco wilt was reisolated from inoculated *C. tora*, cotton, *H. esculentus*, sage, soy-bean, and *R. scabra*. Sweet potato plants were invaded by the agent of cotton wilt (*F. oxysporum* f. *vasinfectum*) [*F. vasinfectum*] either from infested field soils or in greenhouse inoculations. *F. vasinfectum* was reisolated from inoculated snapdragon [*Antirrhinum majus*], and the tomato wilt *Fusarium* [*F. bulbigenum* var. *lycopersici*] from inoculated sweet potato and mimosa (*Albizzia julibrissin*).

Stem and root sections of cotton plants inoculated with *F. oxysporum* f. 2 from sweet potato were plated on potato dextrose agar to determine the location of the fungus in the host. It was recovered from the wood of the tap-root and the basal inch of stem, and also from the bark of the latter, but not from the 12th inch of the stem or upwards.

Mixed cultures of *F. vasinfectum* and *F. oxysporum* f. 2 were inoculated into cotton, and both species were reisolated from wilting plants. The reisolations frequently gave rise to V-shaped sectors with characteristics of one or other of the original cultures. Had it not been known that the inoculum was a mixed culture, these sectors might have been regarded as variants of *F. vasinfectum*. The results of these experiments clearly demonstrate the need for the use of monosporous isolates to determine host relationships.

Wickerham (L. J.) & Burton (K. A.). **Carbon assimilation tests for the classification of yeasts.**—*J. Bact.*, lvi, 3, pp. 363–371, 1 fig., 1948.

As a result of studies carried out at the Northern Regional Research Laboratory, Illinois, for several years the number of compounds used in assimilation tests [cf. *R.A.M.*, xxvi, p. 81] has been increased, the additional compounds proving of great value in the classification of yeasts [ibid., xxvii, p. 47]. These expanded tests may also prove useful in the classification of bacteria, moulds, and algae.

Pridham (T. G.) & Gottlieb (D.). **The utilization of carbon compounds by some Actinomycetales as an aid for species determination.**—*J. Bact.*, lvi, 1, pp. 107–114, 1948.

In studies carried out at the University of Illinois to aid the identification of a group of antibiotic-producing actinomycetes, it was found that in a chemically defined medium all the *Streptomyces* spp. utilized D-glucose, D-mannose, starch, dextrin, and glycerol, but not erythritol, phenol, *o*-cresol, *m*-cresol, *p*-cresol, sodium formate, sodium oxalate, or sodium tartrate. Utilization of the other carbon compounds varied with the particular species and all the antibiotic-producing isolates could be separated on the basis of their growth responses.

Hawker (Lilian E.). **The effect of certain growth substances on mycelial growth and fruiting of Melanospora destruens Shear.**—*Trans. Brit. mycol. Soc.*, xxx, pp. 135–140, 2 pl., 1948.

The author briefly recapitulates the results of her studies (some in collaboration

with R. P. Asthana) prior to 1946 showing that the production of perithecia by *Melanospora destruens* [cf. *R.A.M.*, xxv, p. 413; xxvii, p. 331] was stimulated by the production of stimulatory substances synthesized by certain fungi, by the reduction in concentration of nutrients, particularly glucose, in the medium, and by the presence of inhibitory metabolic substances. Experiments having demonstrated an increase in respiration rate in the presence of aneurin, a further investigation of the possible correlation between respiration rate and fruiting of certain fungi is in progress. Unpublished data demonstrate that a high respiration rate on a sucrose medium, as compared with the rate on a glucose medium of the same concentration, is correlated with poorer mycelial development and more numerous perithecia on the former. Evidence has been obtained which suggests that energy relationships play an important part in the processes leading to perithecial production.

Gram (E.). **Kartoflens Sygdomme i Billeder og Tekst. 2. Udgave.** [Potato diseases in pictures and text. Second edition.]—108 pp., 23 col. pl., 14 figs., Copenhagen, Det Kgl. Danske Landhusholdningsselskab, 1945. [Received January, 1949.]

This useful manual deals in popular terms with the principal physiogenic, virus, bacterial, and fungal disease and insect pests of potatoes in Denmark. The coloured plates should assist growers in the identification of the various diseases, which include, *inter alia*, ring rot (*Bacterium* [*Corynebacterium*] *sepedonicum*) or a disease similar to the one described under this name from North America.

Directions are appended for the control of late blight (*Phytophthora infestans*) by spraying with Bordeaux mixture, for tuber disinfection, e.g., with aretan or uspulun, and for storage, together with notes on the production of healthy 'seed' and on varietal reactions to various diseases.

Andrén (F.). **Besprutningsförsök mot Potatisbladmögel 1948.** [Spraying experiments against Potato late blight in 1948.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, *1948*, 6, pp. 85–87, 1 fig., 1948.

As in former years, the spraying experiments against potato blight (*Phytophthora infestans*) were carried out in 1948 in two localities of Sweden [cf. *R.A.M.*, xxvi, p. 351], using the Magnum Bonum variety in one and Up-to-Date in the other. The incidence of storage rot (assessed on the Up-to-Date tubers only) was lowest in the lots sprayed with 2 per cent. Bordeaux mixture [ibid., xxvii, p. 442], followed by 2 per cent. usit and 0·4 per cent. perenox (0·05, 0·4, and 0·9 per cent., respectively, compared with 16·1 per cent. in the controls). On 8th October the ratings for blight on the foliage of the same variety in a 10-grade scale were as follows: Bordeaux a trace; Bordeaux powder Jofurs, usit, 0·5 per cent. obesan, perenox, and 0·4 per cent. Sandoz, 0·5; 2 per cent. cuzol, 1·2; 1 per cent. kopsit, 1·5; 0·5 per cent. Prep.Z, 4; bioquin, 10; and control, 10. On 6th September the blight counts on Magnum Bonum were Bordeaux a trace, Bordeaux powder Jofurs 1, usit 1·5, Sandoz 2·2, cuzol 2·5, kopsit 3·8, and controls 6·2.

The advantageous effect of the treatments on yield was particularly noticeable in the case of Up-to-Date, the maximum of 27,500 kg. per ha., as against 20,390 in the controls, being produced in the obesan plots.

Björling (K.). **Bidrag till kännedomen om Potatiskräftsvampens (Synchytrium endobioticum [Schilb.] Perc.) biologi.** [Contribution to the knowledge of the biology of the Potato wart fungus (*Synchytrium endobioticum* [Schilb.] Perc.).] —*Medd. Växtskyddsanst., Stockh.*, 52, 21 pp., 8 figs., 1948. [English summary.]

In conjunction with the annual tests (in progress since 1936) of Swedish potato-breeding material for resistance to wart disease (*Synchytrium endobioticum*) [*R.A.M.*, xxv, p. 136], some observations have been made and experiments performed which

illustrate certain features in the biology of the pathogen. Since 1943 Lemmerzahl's method of inoculation [ibid., xi, p. 70] has been modified by the use of strips of wood or masonite in place of soil as a covering for the tubers after infection.

Since the beginning of the resistance trials a certain number of sprouts, varying from year to year, have failed to react to inoculation with *S. endobioticum* by tumour formation on account of preceding infection by *Corticium solani*. In 1944–5, 99 of the 279 susceptible varieties (35·5 per cent.) were virulently infected by the latter fungus at the time of inoculation, and in this group the percentage of sprouts developing tumours was only $48{\cdot}5 \pm 2{\cdot}44$, as against up to 100 per cent. in uninfected ones and $58{\cdot}8 \pm 2{\cdot}48$ in those damaged by miscellaneous factors. Of a total of 820 tumour-free varieties provisionally classified as wart-immune, 381 (46·5 per cent.) were found to be more or less extensively infected by *C. solani*, and the average incidence of stem canker in the entire breeding material was 43·8 per cent. It is estimated that about 2·5 per cent. of all the varieties tested were erroneously placed in the provisionally immune category owing to the absence of tumour formation in the presence of the antagonistic fungus.

In a joint inoculation experiment on the wart-susceptible Magnum Bonum variety, 40 sprouts were infected with *C. solani* and four days later, when they were overrun by hyphae, *S. endobioticum* was superimposed on 30 of these sprouts and inoculated into a further 30 untreated ones. During the month covered by the experiment the temperature ranged from 14° to 32° C. The number of sprouts developing tumours following inoculation with *S. endobioticum* alone was 28, as against only four of those in the combined series. On some of the tumour-free sprouts inoculated with both fungi were formed black necroses, which later split up into irregular patterns and were strongly reminiscent of the symptoms of chronic abortion developing on certain immune varieties infected by *S. endobioticum* [ibid., xi, p. 69]. On other jointly inoculated sprouts punctiform, dark brown necroses (abortive sori) appeared, while some were covered with a close network of hyphae of *C. solani*.

Two processes, one specific and the other non-specific, are thought to be involved in the mechanism of tumour inhibition and the development of necrotic symptoms. The non-specific process, presumably induced by *C. solani*, consists in the disorganization of the epidermal cells of the sprouts which are indispensable to the development of *S. endobioticum*. The abortive sori and resting sporangia, representing the partial penetration of the intact host cells by the wart disease fungus, may also induce specific necrotic reactions contributing to the development of the general symptom picture.

Inoculation experiments with *S. endobioticum* were performed on tubers of the susceptible (President, Bintje, Birgitta, and Karna) and immune (Ackersegen and Voran) varieties (*a*) healthy and (*b*) infected with one or more of the viruses X, Y, and leaf roll. The results showed that the virus infections exerted no influence on reaction to wart disease.

In view of Braun's report of the existence of two new physiologic races of *S. endobioticum* attacking many varieties previously regarded as immune in Germany and Czechoslovakia [ibid., xxii, p. 273], an analysis was undertaken of the wart material discovered in 16 new localities in southern and central Sweden between 1944 and 1947 [ibid., xxvi, p. 352]. In greenhouse tests with the individual collections on an assortment of varieties, all induced normal reactions, the susceptible being attacked and the immune remaining free, with the exception of two small tumours with mature sori on Majestic. However, in field experiments with this variety, among others, in the place of origin of the collection in question, Majestic remained completely tumour-free despite heavy soil contamination. From these results the existence of a new physiologic race of *S. endobioticum* in Sweden appears highly improbable.

New varieties of the Potato introduced since 1939.—*Leafl. Dep. Agric. Scot.*, N.S., 2, 8 pp., 1948.

Descriptive notes are given of new potato varieties offered for sale in Scotland since 1939 [*R.A.M.*, xxvii, p. 579]. Orion (recommended for registration in 1947) shows foliage and moderate tuber resistance to blight [*Phytophthora infestans*: cf. ibid., xxvii, p. 539]. Home Guard (an unregistered variety which has become established on the market) is not much affected by dry rot [*Fusarium caeruleum*: ibid., xxvi, p. 79]. Vanguard [ibid., xx, p. 30], registered in 1939, primarily for wartime use, is relatively resistant to scab [*Actinomyces scabies*]. The Dutch variety, Record, cultivated in Scotland in recent years, is immune from wart [*Synchytrium endobioticum*: cf. ibid., xxv, p. 575].

Hollis (J. P.). **Oxygen and carbon dioxide relations of Fusarium oxysporum Schlecht. and Fusarium eumartii Carp.**—*Phytopathology*, xxxviii, 10, pp. 761–775, 3 figs., 1 graph, 1948.

The effects of different oxygen and carbon dioxide concentrations [cf. *R.A.M.*, ii, p. 25] on the growth and morphology of *Fusarium oxysporum* and *F.* [*solani* var.] *eumartii*, agents of potato wilt [ibid., xvi, p. 56], were studied in pure culture on potato dextrose agar at the Nebraska Agricultural Experiment Station. The development of the two species in sand and various sand-compost mixtures was investigated in relation to moisture content, texture, and forced aeration.

F. oxysporum showed a greater tolerance of lowered oxygen tensions than *F. eumartii*, sealed cultures of the former being viable after 13 weeks, whereas those of the latter were non-viable at the end of three. Both species exhibited considerable tolerance of high carbon dioxide concentrations, to which *F. oxysporum* was more sensitive than *F. eumartii*. It may be concluded, however, that neither fungus would generally suffer material damage from concentrations of carbon dioxide below 48 per cent. in the soil atmosphere.

The culture of *F. oxysporum* used in these studies (No. 293 of the Department of Plant Pathology, University of Nebraska) showed a definite morphological response to lowered oxygen tensions [shown in figures as crinkled hyphae with many short branches compared with the straight normal ones]. Rupture of the hyphal tips and extension of their protoplasmic contents were observed two to three hours after restoration of the colonies to air but not after 15 hours. It was thought that this reaction might be common to other species of *Elegans*, and five additional isolates falling into this section, i.e., two of *F. oxysporum* var. *cubense*, one of *F. lini*, and two further Nebraska isolates of *F. oxysporum*, as well as 12 representing forms described by Snyder and Hansen [ibid., xxv, p. 366], were accordingly tested, but with negative results.

In an unaerated sand-composted soil mixture nearly equal penetration by both species was effected at all moisture levels (60, 80, and 100 per cent. moisture-holding capacity), with the growth ratio of the two organisms approximating that obtained in pure culture [cf. ibid., xx, p. 171]. In both unaerated and aerated soil, greater penetration occurred at moisture levels below saturation. Under forced aeration in composted soil the fungi were active at moisture levels below 48 per cent. moisture-holding capacity.

Watanabe (T.). **Studies on the vaccine therapy of the stem rot of Sweet Potatoes.**—90 pp., 6 pl., Utsunomiya Agricultural College, Utsunomiya, Japan, 1942. [Received February, 1949.]

The resistance to stem rot of stems of Kawagoe-Beniaka sweet potatoes increased when they were injected with or immersed in culture filtrates (vaccines) of strain no. 14 of the stem rot organism [*Fusarium bulbigenum* var. *batatas*: cf. *R.A.M.*, xix, p. 191] grown in Richards's solution. Injections (20 places on the stem) done

four times at two-hourly intervals with a 1:10 dilution of filtrates from cultures in Richards's solution containing lactic acid (5 in 50) induced the most effective resistance to wound inoculations with cultures of the fungus made four to five days later. A 1:2 dilution of Richards's solution culture filtrate passed through a Berkefeld filter was most effective when injected three times. In the immersion experiments immersion for 15 hours in a 1:5 dilution of Richards's culture filtrate (plus 5 in 50 of a 1:5,000 potassium bichromate solution) gave the most effective results.

Dry vaccine A (macerated mycelial felt, dried for 48 hours at 37° C., ground again, and dried for a further 24 hours) restricted infection in plants grown in mineral culture solutions most effectively when used at 0·002 to 0·004 per cent., and dry vaccine B (in which the mycelium was treated with ether before drying) at 0·004 to 0·008 per cent. A heat vaccine, made by heating a mycelial suspension in water at 70° for 30 minutes, centrifuging, and using the supernatant liquid, gave the lowest percentages of infection when used at a dilution of one in five.

Inoculated stem cuttings from sprouted storage roots, which had been immersed, before planting, in living vaccine (filter paper culture filtrates), Berkefeld filtered vaccine, dry vaccine A solution, or dry vaccine B solution, consistently showed a lower percentage of infection than those from untreated roots and ones treated for 5, 10, or 20 minutes with 1:1,000 mercuric chloride solution. Immersion of the roots for eight hours in 0·04 per cent. solution of dry vaccine B gave particularly good results in immunizing sweet potato plants against stem rot.

It appears that there is a toxin which is the outstanding factor enabling the vaccines to increase the resistance of the plants against the disease.

Watanabe (T.). **Studies on the physiologic specialization in Fusarium sp. causing the stem rot of Sweet Potatoes.**—*Bull. Utsunomiya agric. Coll.*, Sect. A, iii, 2, pp. 43–104, 3 pl., 1941. [Received February, 1949.]

Watanabe (T.). **On the anatomy of Sweet Potatoes affected by the stem rot fungus.**—*Bull. Utsunomiya agric. Coll.*, Sect. A, iii, 2, pp. 105–117, 2 pl., 1941. [Received February, 1949.]

These are full accounts in English of work already noted from the English summaries of the Japanese versions [*R.A.M.*, xviii, p. 496; xix, p. 191, and preceding abstract.]

Hansford (C. G.) & De Silva (C. A.). **Botanical and Mycological Department.**—*Rep. Rubb. Res. Bd Ceylon, 1947*, pp. 7–18, 1948.

It is stated in this report [cf. *R.A.M.*, xxvi, p. 262] that during 1947 *Oidium* leaf disease [*O. heveae*: ibid., xxvii, p. 582] of rubber appeared at the beginning of February, 1947, as a few scattered colonies on the upper surfaces of the nearly fully formed leaves, producing abundant conidia for three to four weeks. Gradually the fungus became more prevalent, but very little leaf shedding occurred. The epidemic died down after the end of March except on the very late-wintering clone PB. 6/9. During November and December in spite of extreme drought, the annual attack was identical with that of the previous season.

The persistence of the fungus in the low country, its annual origin, and clonal resistance and susceptibility were studied. In September, 1947, at Dartonfield PB. 6/9, which had previously suffered severe defoliation caused by *Phytophthora* [*P. palmivora* and *P. meadii*: loc. cit.], bore no *Oidium* on the abundant new foliage. However, on 1st October colonies were found on one tree. It is suggested that *Oidium* probably exists on a very small scale throughout the year in the low country. This would account for the few colonies appearing on the very early-wintering trees each season. So far none of the Ceylon clones have proved

sufficiently resistant to be of commercial value. The late-wintering HC.28 shows some promise.

Since the conditions causing the sudden increase in severity of *Oidium* on young bronze leaves each year are not known, it is impossible to give more than four to five days' warning of an impending epidemic which is too short a period for most estates. There is no prospect of a long-term forecast being possible in the near future. The fungus attacks only young leaves (up to three weeks old) and remains in a sporulating condition for six to eight weeks at the most, after which its mycelium dies away. Spots and deformations sometimes found on mature leaves are the results of early infection. Control measures for districts liable to severe annual attacks comprise very careful supervision and frequent sulphur dusting. A recent Rubber Commission [ibid., xxvii, p. 449] recommended, however, that rubber is no longer a profitable crop in such areas.

The *Phytophthora* epidemic in August and September, 1947, was the worst for the last 20 years. No resistant clones were observed. Leaf fall was followed by various forms of bark rot and canker on branches and stems, from which the clones TJ.1, PB.86, HC.28, and GL.1 suffered less than BD.5 and PB.183. The present economic situation of the rubber industry makes control measures for leaf fall impossible, but all patches of stem and branch attacked should be cleaned up annually.

Dennis (R. W. G.). **Boron and plant life—Part VI. Developments in agriculture and horticulture, 1943–46.**—Reprinted (with addition of bibliography) from *Fertil. Feed. St. J.*, 62 pp., 7 figs., 1948.

In continuation of the earlier work on the subject [*R.A.M.*, xxiii, p. 244] the author reviews 298 papers on boron in relation to plant life published during the years 1943 to 1946. The papers dealt with were published in all parts of the world, and the range of crops considered is also world-wide.

Brown (B. M.), Lasman (W. C.), Wilmot (J.), & Hodgson (N.). **Brewing trials with varieties of Hops showing some resistance to Verticillium wilt.**—*J. Inst. Brew.*, N.S., xlv, 2, pp. 105–106, 1948.

Full-scale brewing trials in draught pale ale of some hop varieties showing a measure of resistance to *Verticillium* [*albo-atrum*] have now been completed [cf. *R.A.M.*, xxv, p. 205]. They were the Wye varieties OB53, OM26, 219, and OR55 and the commercial 1147 [ibid., xxviii, p. 141]. With the possible exception of 219, all proved acceptable for brewing.

Crandall (B. S.) & Dieguez (J.). **Phytophthora stem canker of Sesame in Peru.**—*Phytopathology*, xxxviii, 9, pp. 753–755, 1 fig., 1948.

Towards the end of 1946, 24 selections of sesame were received at the Tingo Maria Experiment Station, Peru, from the National Centre of Agronomy, Salvador. Just before the fruits reached maturity in late February, 1947 (during the wet season), wilted plants were observed in the lower, poorly drained sections of the plots, and closer inspection revealed extensive stem cankers between the collar and the tip of the growing point. Girdling infections at the collar led to complete wilting of the plant. Infection apparently originated in the leaves or young lateral branches and spread much more rapidly in a vertical than in a horizontal direction. Dissection of the cankers indicated that the pathogen was primarily an invader of cambium and phloem tissue. Some infection of the fruits was also noted.

The fungus isolated in pure culture from the advancing margins of the cankers was a species of *Phytophthora* with sporangia measuring 37·4 to 51 by 23·8 to 27·2 (mean 39·7 by 25·5) μ, produced on branching sporangiophores, and oogonia averaging 25·5 μ with paragynous antheridia. It is apparently identical with *P. cactorum*.

All the varieties inoculated in the trial plots by inserting mycelium from a culture into a cut extending through the cambium showed ten days later extensive cankers. Among the most susceptible varieties were Brazilian, Natural Indian White, Indian F.A.Q., Indian No. 2, and Nicaragua; on these the canker measurements varied widely according to the drainage of the planting site, being 15·3, 14·7, 13·8, 15·2, and 12·2 cm., respectively, on wet ground and 2·4, 5·2, 0·4, 3·3, and 1·6 cm., respectively, on dry. The greater liability to stem canker of plants on wet sites indicates the advisability of dry-season cultivation, but crops raised in the wet season should not suffer unduly if proper drainage is effected. The disease, though serious, is not at present a limiting factor in the growth of sesame in the El Tingo region.

This appears to be the first record of a *Phytophthora* causing sesame canker, but a root rot caused by an unidentified species of the same genus reported by Ciferri from the Dominican Republic [*R.A.M.*, ix, p. 512] might possibly be another manifestation of the same disease.

McMartin (A.). **Sugarcane smut. A report on visits to the Sugar Estates of Southern Rhodesia and Portuguese East Africa, with general observations on the disease.**—*S. Afr. Sug. J.*, xxxii, 12, pp. 737, 739, 741, 743, 745, 747, 749, 1948.

Sugar-cane smut [*Ustilago scitaminea*] appears to spread much more slowly in Natal than on the Southern Rhodesian and Portuguese East African estates visited [*R.A.M.*, xxvii, p. 157]. This may be due to the biennial cutting practised in Natal instead of the annual in the other regions. There are also indications of a more rapid spread of infection in dry areas requiring irrigation. Observations and experiments point to the use of apparently healthy but actually infected seed as an important factor in the dissemination of the smut. It is suggested that a trial should be made of the tops of two-year-old cane as 'seed', which may be expected to remain healthy if the smut 'whips' have not appeared by that age. A rapid increase of the disease in ratoon cane is usually experienced. Some varieties, e.g., Co.301, are so extremely susceptible as to preclude the production of reasonably good crops. Other highly susceptible ones are P.O.J.36, P.O.J.213, P.O.J.234, and Co.213, whereas P.O.J.2714, P.O.J.2878, P.O.J.2727, P.O.J.2725, P.O.J.2961, M.28, F.C.1017, and Co.421 are immune or highly resistant. It is significant that the most highly susceptible canes are derived from crosses between *Saccharum officinarum* and *S. barberi* and the most resistant from *S. officinarum*×*S. spontaneum*, with the trispecific hybrids intermediate in their reaction to the smut.

King (N. J.). **Report of the Bureau of Sugar Experiment Stations.**—*Rep. Dep. Agric. Qd, 1947–48*, pp. 28–33, 1948.

It is stated in this report [cf. *R.A.M.*, xxvii, p. 384] that in seventeen soil trials for minor elements in the main sugar-producing areas, one only, a poor sandy loam in the Nambour area, shows any deficiency and appears to be responding to zinc plus copper.

Fiji disease [ibid., xxvii, p. 496] still causes some concern in southern Queensland. It is under control in the Bundaberg district except for the plantations at Bingera, where the vigorously growing canes and standover practices make eradication by roguing difficult. Susceptible varieties were seriously attacked in the Moreton area and a policy of harvesting and ploughing out is being continued.

Downy mildew [*Sclerospora sacchari*: loc. cit.] is now restricted to a small part of the Bundaberg area and it is expected that the recent prohibition of P.O.J.287 will lead to the disappearance of the disease within a few years.

Gumming disease [*Xanthomonas vasculorum*] has not spread outside the Mossman district; susceptible varieties such as S.J.4 and H.Q.426 can still be cultivated

in the southern part of the area. Some losses were caused in the northern mill district by leaf scald [*X. albilineans*: ibid., xxvii, p. 497]. Farmers are advised to procure plants from the better-drained, disease-free areas.

Chlorotic streak still causes serious yield reductions in North Queensland. In the south, at Moreton, the susceptible P.O.J.2878 yielded 24 tons per acre, healthy plants 34·5. Hot-water-treated plants yielded practically the same as the healthy ones.

Dwarf disease was found outside the Mackay area at Pindi Pindi. The replacement of susceptible varieties with disease-free Q.28 and Q.50 and a careful selection of planting material is recommended.

Red rot [*Physalospora tucumanensis*: ibid., xxvii, p. 495] caused some losses in the Moreton area in Co.290. Though it is considered a minor disease (except when dry conditions and late harvesting accentuate the losses), it causes enough damage to prevent susceptible varieties, such as Q.52, from being planted.

The results of further experiments showed that dipping setts before planting in a 0·015 per cent. solution of an organic mercury compound increases germination under favourable conditions. In the Inkerman area poor germination, due to pineapple disease [*Ceratostomella paradoxa*] has led to greatly increased costs of production and several farmers are installing equipment for dipping. In the winter of 1948 about 140 tons of plants were treated in addition to setts for replacement of misses.

Brandes (E. W.) & van Overbeek (J.). **Auxin relations in hot-water-treated Sugarcane stems.**—*J. agric. Res.*, lxxvii, 7, 8, pp. 223–238, 8 figs., 1948.

Greenhouse and field experiments conducted at Beltsville, Maryland, and in Puerto Rico showed that immersion of sugar-cane stems and cuttings in hot (52° C.) water for 20 minutes stimulated the development of lateral buds and suppressed geotropic reaction. There was a gradual decrease of free auxin level in the treated material, sometimes by 50 per cent. or more. Evidence indicates that these two effects are correlated.

Skolko (A. J.) & Groves (J. W.). **Notes on seed-borne fungi. V. Chaetomium species with dichotomously branched hairs.**—*Canad. J. Res.*, Sect. C, xxvi, 3, pp. 269–280, 7 pl., 1948.

The following species of *Chaetomium* with dichotomously branched hairs, a key to the identification of which is given, were isolated from various commercial and registered agricultural seed stocks received at Ottawa [cf. *R.A.M.*, xxvi, p. 405 and next abstract] and are fully described: *C. elatum* from celery, beet, Swiss chard (*Beta vulgaris* var. *cicla*), vegetable marrow, carrot, lucerne, parsley, pea, radish, and alsike clover (*Trifolium hybridum*); *C. dolichotrichum* from flax, pea, and radish; *C. funicolum* from onion, cabbage, turnip, cucumber, meadow fescue (*Festuca elatior*), soy-bean, flax, tomato, pea, hairy vetch (*Vicia villosa*), and maize; *C. indicum* from Swiss chard, carrot, flax, rye grass (*Lolium perenne*), tomato, bean (*Phaseolus vulgaris*), pea, and Russian dandelion (*Taraxacum kok-saghyz*); *C. erectum* n.sp. from parsley seed in July, 1943, and *C. reflexum* n.sp., from tomato, pea, okra (*Hibiscus esculentus*), and [chilli] pepper (*Capsicum annuum*). Although species of *Chaetomium* are usually regarded as saprophytes, seed samples heavily infected by them show a corresponding low germination and emit a characteristic odour. Cultures of *Chaetomium* can frequently be distinguished by this odour before fruiting.

Cain (R. F.) & Groves (J. W.). **Notes on seed-borne fungi. VI. Sordaria.**—*Canad. J. Res.*, Sect. C, xxvi, 5, pp. 486–495, 5 pl., 27 figs., 1948.

Descriptions are given of five species of *Sordaria* isolated from agricultural seeds during examinations for the presence of seed-borne fungi in Canada [cf. preceding

abstract]. Three, *S. fimicola* (isolated from a wide variety of seeds), *S. humana* (from maize), and *S. setosa* (from beet) are common coprophilous fungi, while *S. inaequalis* n.sp. (from various seeds) and *S. curvispora* n.sp. (from carrot and celery) are described for the first time. The fungi do not appear to have any pathological significance.

Waterston (J. M.). **The fungi of Bermuda.**—*Bull. Dep. Agric. Bermuda* 23, 305 pp., 36 figs., 2 maps, 1947.

Much of the material collected by the late Professor H. H. Whetzel in his phytopathological surveys of Bermuda, conducted jointly with Dr. F. J. Seaver and L. Ogilvie in 1923 and 1926, remained unstudied at Cornell University until 1944, when the author was granted a year's leave of absence from the Colony to assist in the determination of these collections, with a view to the completion of this valuable annotated list of Bermuda fungi [cf. *R.A.M.*, xviii, p. 550; xix, p. 616]. A number of species are illustrated by plates. The list is preceded by an introduction describing the geology, climate, and economy of the Islands; a chronological review of mycological and phytopathological work in Bermuda; informative observations on collecting stations, the seasonal incidence of species collected, and fungi not yet found in Bermuda; and a statistical summary of the fungi recorded to date from the Colony. Fungus and host indices and a 17-page bibliography are appended.

Arnaud (G.). **Distribution géographique des champignons du genre Meliola.** [The geographical distribution of fungi of the genus *Meliola*.]—*C.R. Acad. Sci., Paris*, ccxxiii, pp. 1019–1021, 1946. [Received December, 1948.]

In 1917, the author showed that the geographical distribution of the genus *Meliola* (*sensu lato* = Meliolineae), so far as these fungi were then known, was associated with amount of rainfall. They were abundantly present in tropical areas and were also found on high mountains in Europe. A few species had also been observed in the marshy parts of plains in temperate latitudes. Later observations have now shown that *Meliola* species are probably the most commonly occurring micro-fungi in Europe, where, however, they are found almost always only in the mycelial state. This mycelium is invariably external and is characterized by its stigmatopodia. A survey of marshy areas near Paris and in the south of France (Gard) everywhere showed that many monocotyledonous plants bore on the sheaths of living leaves near wet ground or water a characteristic mycelium of *Meliola*. This mycelium might extend to all the leaf sheaths enclosed within one another and to the flower stem also. It was observed on many species of *Carex*. On each host the characters of the stigmatopodia differed, and several species of *Meliola* were, therefore, probably present.

Venkatarayan (S. V.). **Smut on the Mat-Sedge, Cyperus pangorei, Rottb.**—*Curr. Sci.*, xviii, 1, p. 13, 3 figs., 1949.

A description is given of *Cintractia peribebuyensis* Spag. on the peduncle bases and spikelets of *Cyperus pangorei* at Bangalore. The sedge is used for mat-making in South India and Ceylon. The identity of the smut was confirmed by microscopic examination, which revealed the distinctive features of *Cintractia*, viz., the lengthy duration of spore agglutination, the central columella of plant tissue, and the development of the spores from within outwards.

Best (R. J.). **Studies on a fluorescent substance present in plants. Part 3 : the distribution of scopoletin in Tobacco plants and some hypotheses on its part in metabolism.**—*Aust. J. exp. Biol. med. Sci.*, xxvi, pp. 223–230, 3 figs., 1948.

Further studies at the Waite Institute, Adelaide, showed that the fluorescent

substance 6-methoxy-7-hydroxy 1:2 benzo-pyrone (scopoletin) [*R.A.M.*, xvi, p. 133] is present in healthy tobacco plants from germination to maturity, when its concentration is at a maximum; a drop occurs during the rapidly growing stage. The greatest concentration is in the external endodermis, followed by the internal endodermis.

Tobacco plants infected with the tomato spotted wilt virus contain a higher concentration of scopoletin (although the relative distribution is the same as in healthy plants), the tissues finally becoming saturated and strongly fluorescent. It is suggested that this excess production is more likely to be due to a diversion of normal metabolism than to a breakdown of lignin or other substances.

GOLDSCHMIDT (W. B.). **'Blue disease' of Tomatoes.**—*Fmg S. Afr.*, xxiii, 266, pp. 333–336, 344, 3 figs., 1948.

During the winter of 1945 severe phosphate deficiency of tomatoes occurred in the Malelane area of the eastern Transvaal Lowveld, accompanied by a marked reduction in yield. The leaves of the plants were reddish purple, mainly on the lower surface, the colour apparently originating from localized pigmented spots. Affected plants were dwarfed, their leaves small, and the setting of the fruit was much delayed. In severe cases the plants died before any fruit was formed. The condition was liable to appear as soon as cold weather set in.

A co-operative field experiment in May, 1947, showed that tomato plants receiving 15·1 per cent. superphosphate (1,500 lb. per morgen [2·17 acre]) at planting-out time appeared perfectly healthy and yielded 2,900 boxes per morgen compared with 1,900 boxes from the plants which received the same amount of superphosphate applied later as two top-dressings. That the condition was due to phosphate deficiency only was established after experiments with other fertilizers had given negative results, and plants treated with pure phosphate had been cured within a week.

Similar manifestations of phosphate deficiency have been observed in *Paspalum dilatatum* and maize when soil is inadequately supplied with phosphates. For a short-term crop such as the tomato, phosphate fertilizers should be applied to the rows at planting-out time at a depth of 3 to 4 in., as near as possible to the major root zone. Superphosphate used alone should be applied at from 800 to 1,500 lb. per morgen according to the root requirements of the crop and the amount of available phosphate in the soil.

SUTTON (W. S.). **Bacterial spot of Tomatoes.**—*Agric. Gaz. N.S.W.*, lix, 11, pp. 595–597, 5 figs., 1948.

Bacterial spot caused by *Xanthomonas vesicatoria* [*R.A.M.*, xxvii, p. 391] was originally of minor importance in New South Wales [ibid., xxiii, p. 475] but has now become a disease of major concern to tomato-growers, particularly in the north coast districts. Losses are also incurred in the central coast and some inland areas. The disease usually enters the farm in the first place on the seed, but once it is established it may live over in the soil, probably for two or three years. The bacterium has also been reported to attack several weed hosts, including the widely distributed nightshade (*Solanum* spp.) which may act as a breeding-ground for the organism. The control measures recommended are seed-steeping in a solution containing $\frac{1}{8}$ oz. mercuric chloride followed five minutes later by rinsing, or immersion for 30 minutes in water heated to 122° F., a four-year crop rotation, replacement of overhead irrigation by some form of trench irrigation, weed destruction, and spraying with home-made Bordeaux mixture (2–2–40) to reduce the rate of spread from plant to plant.

Armillaria mellea in Nyasaland.—*Rep. For. Dep. Nyasald*, 1946. [Abs. in *For. Abstr.*, x, 2, p. 250, 1948.]

In Nyasaland *Armillaria mellea* is widespread and attacks tea, tung [*Aleurites fordii*], and many exotic species. Among exotic pines, *Pinus longifolia* is most severely affected, followed by *P. khasya* and *P. caribaea*, while *P. patula* seems almost unaffected. All indigenous species are to be ring-barked one year before clearing new areas for planting.

Kelley (A. P.). **Further studies on the continued growth of American Chestnut.**—6 pp., Landenberg Laboratory, Landenberg, Pennsylvania, 1948. [Abs. in *For. Abstr.*, x, 2, p. 251, 1948.]

In a further survey of *Castanea dentata* in plots [cf. *R.A.M.*, xxiii, p. 367], the author found that seedlings growing in shade appeared unaffected by blight [*Endothia parasitica*: cf. ibid., xxvii, p. 590], while those in full sunlight were mostly affected. Vigorous shoot growth was observed on many diseased stumps. Many cankers had healed.

Preston (A.). **On intraspecific variability of Eucalyptus timber to fungal rotting.**—*Emp. For. Rev.*, xxvii, 1, pp. 133–135, 1 map, 1948.

An experiment was carried out in Victoria, Australia, to obtain data on the extent of the variability to fungal attack in timber from individual trees or from trees situated in widely separated localities in order that future laboratory work could be standardized.

Samples of durable timber (*Eucalyptus rostrata*) and non-durable (*E. regnans*) from three areas in Victoria were cut into blocks 2 in. by 1 in. by 1 in. with the larger surface cut across the grain, and inoculated with *Polyporus anthracophilus* and two unknown cultures Nos. 6 and 21, all isolated from decayed *E. regnans*, and with *Coniophora cerebella* [*C. puteana*], *Poria xantha*, and *Trametes serialis* isolated from decayed mine-timber [*R.A.M.*, xxvii, p. 302]. The Leutritz soil method [ibid., xxviii, p. 101] was employed in assessing the results which showed that *E. rostrata* is very resistant to fungal attack.

Nos. 6 and 21, *Polyporus anthracophilus*, *Poria xantha*, and *T. serialis* caused only from 1 to 6·6 per cent. loss in dry weight of *E. rostrata* blocks after six months' incubation, with means ranging from 1·5 to 2·8 per cent. *C. puteana*, however, was more active, causing a significantly greater percentage rot (mean 14·1 per cent.) than the other fungi. For this timber none of the three areas was associated consistently with a greater rotting effect than any other area, although the effect of *C. puteana* was greatest on material from Barmah and least on material from Cohuna. For no fungus was there a significant difference in susceptibility to rot in the individual trees of any one area.

E. regnans proved much more susceptible to fungal attack than *E. rostrata*. The mean loss of weight caused by the six fungi in six months ranged from 21 to 57 per cent. No. 6 and *Poria xantha* caused significantly less loss in weight than the other four, with *C. puteana* again the most active wood-rotting species. The effect of area was significant at the 5 per cent. level, the rot percentage being greatest for material from Cumberland (average 19). The effect of the fungi on *E. regnans* varied between individual trees in a highly significant manner. The higher rot percentage in material from the Cumberland Valley is possibly due to more rapid growth, in an area receiving a higher average annual rainfall.

It is concluded that for durable timbers such as *E. rostrata*, test specimens may be taken from single trees, while for susceptible timbers such as *E. regnans* a single sample tree from one area cannot be taken as representative for testing fungal effects. In future work, timber samples should be taken from several trees of each of several areas.

Nobles (Mildred K.). **Studies in forest pathology. VI. Identification of cultures of wood-rotting fungi.**—*Canad. J. Res.*, Sect. C, xxvi, 3, pp. 281–431, 18 pl., 3 figs., 1948.

In this valuable work of reference a numerical key is given for the identification of 126 species of wood-rotting fungi by means of their cultures, with descriptions of the cultural characters of each species. The species, the majority of which belong to the Polyporaceae, include many of the fungi most frequently encountered in studies of decay in various hosts, having been chosen without restriction as to host or locality. The descriptions and key are based on macro- and microscopic cultural characters exhibited by the fungi when grown on plates of malt agar and on malt agar plus gallic or tannic acid, incubated in the dark at room temperature and examined at weekly intervals for six weeks. Host relationships and physiological and morphological characters also proved to be of diagnostic value.

The key consists of a series of 'key patterns' [*R.A.M.*, xxi, p. 395]. Each column of digits in the key refers to a specific diagnostic character. The first column refers to the host, the second to the colour of the mycelial mat, the third to the reaction on media containing gallic and tannic acids, the fourth to the septation of hyphae, the fifth to special structures (0 to 8, specific structure present, 9, no special structure), the sixth to chlamydospores, the seventh to conidia, the eighth to oidia, the ninth to growth rate, the tenth to fruiting, and the eleventh to the effect on the agar medium. Each digit in each column has a precise meaning. The numerical key permits the interpolation of additional species as their code numbers are prepared. A glossary of the terms used in describing the advancing zone of the colony, the texture of the mat, and the microscopic characters, is given. For a given species the key pattern is prepared by considering the diagnostic characters of the species in the order in which they occur in the key and choosing the proper digit from each column. For some species descriptive keys are inserted for more positive identification.

Hunter (Lillian M.). **A study of the mycelium and haustoria of the rusts of Abies.**—*Canad. J. Res.*, Sect. C, xxvi, 3, pp. 219–238, 45 figs., 1948.

A study of the mycelia and haustoria of 19 rusts in the leaves of *Abies* [*R.A.M.*, xxvi, p. 60] revealed that the haustoria of *Melampsorella caryophyllacearum* [*M. cerastii* in summary: ibid., xx, p. 387], *Hyalopsora aspidiotus* [*H. polypodii* in summary], and *Milesia polypodophila* were sufficiently characteristic to serve as diagnostic criteria for the species, those of the first-named being botryose, the second very large, and the third closely spiral. The haustoria of the six species of *Uredinopsis* were similar to each other, being hyphal in form, while those of *P. epilobii* and *P. abieti-chamaenerii* were simple, hyphal, straight or curved, and usually unbranched. Those of *Calyptospora goeppertiana* were hyphal and very slender while those of *M. scolopendrii* and *M. vogesiaca* [ibid., xv, p. 469] were hyphal or of loose spiral form. The haustoria of *M. polypodophila* and certain other rusts in their aecidial hosts differ from those in their telial hosts: the haustoria of *M. kriegeriana* [loc. cit.] are hyphal, resembling those of *M. intermedia*. In *M. polypodii* they are characteristically branched, serving as an aid to identification. Of these rusts 18 are described for the first time in the aecidial host. The relationship of the rust haustoria in the case of *A. balsamea* is considered to be of a highly symbiotic nature at least until near maturity.

Hewitt (E. J.), Jones (E. W.), & Nicholas (D. J. D.). **The production of molybdenum deficiency in plants in sand culture with special reference to Brassica and Tomato crops.**—*Rep. agric. hort. Res. Sta. Bristol, 1947*, pp. 70–81, 1 pl., [? 1948].

This study has already been noticed from another source [*R.A.M.*, xxvii, p. 401].

Hanson (A. A.), Coulson (J. G.), & Raymond (L. C.). **Further studies on brown heart in Swedes.**—*Sci. Agric.*, xxviii, 6, pp. 229–243, 1 pl., 1948.

Further studies on brown heart of field-grown swedes in Ontario [*R.A.M.*, xvi, p. 431; xxvii, p. 505] from 1933 to 1945 revealed that a significant positive relationship existed between brown heart and the amount of rainfall received by the crop during August and September and a negative correlation with the hours of sunshine. The greatest increase in the incidence of the disorder occurred over a one- to two-week period in the middle of August.

Sludsgaard and Bangholm 8312 were extremely susceptible to brown heart, Corning and Ditmar's Bronze Top partially resistant, while in the intermediate group Pajberg and Laurentian were apparently inferior to Bangholm 8112, Acadia, and Wilhelmsburger.

In the years 1940, 1941, and 1942, only 3·9 per cent. brown heart occurred in plots receiving borax at 50 lb. per acre broadcast before seeding as against 15·5 per cent. in plots receiving 25 lb. per acre. Sprays applied to the foliage at 8 and 16 lb. when the roots were 1 to 1½ in. in diameter, two weeks later, one month later, and as a split spray (one application at the 1 to 1½ in. stage and another one month later) proved superior to dry applications to the soil. The sprays applied at one month gave significantly less control (12·6 and 9·9 per cent. brown heart, respectively) than the other schedules with the exception of 8 lb. at two weeks (5·9 per cent. brown heart). In a limited field test little brown heart developed in plots with and without added potash receiving a split borax spray, but when 250 lb. muriate of potash per acre were added to the non-sprayed and to the plot receiving 25 lb. dry borax the amount of brown heart increased by 11·7 and 8·5 per cent., respectively. It is advisable to apply borax to a swede crop from which roots are to be selected for seed production to ensure freedom from brown heart and optimum yields.

Roland (G.). **Sur une virose nouvelle de la Betterave : la jaunisse des nervures.** [A new virus disease of Beet: vein yellowing.]—*Parasitica*, iv, 3, pp. 152–154, 1 fig., 1948. [Flemish summary.]

During 1947 vein yellowing was observed in forage beets growing near Gembloux. Nine young plants of the Rose de Vilmorin variety were colonized with *Myzus persicae*, previously fed for one hour on a plant showing these symptoms. After about 28 days two showed yellowing of the outer leaves and vein yellowing of one young leaf. A third plant showed vein yellowing only. The chlorosis was accompanied by necrotic streaks following the course of the veins. The virus was not sap-transmissible. In symptoms and transmissibility the vein yellowing virus corresponds to that described by Sylvester [*R.A.M.*, xxviii, p. 105]. Its relation to beet yellows virus, which it resembles in insect transmission, has yet to be established.

Gorenz (A. M.), Walker (J. C.), & Larson (R. H.). **Morphology and taxonomy of the Onion pink-root fungus.**—*Phytopathology*, xxxviii, 10, pp. 831–840, 3 figs., 1948.

Studies were made at the Department of Plant Pathology, University of Wisconsin, on the morphology of numerous isolates of the onion pink-root fungus, referred by Hansen to *Phoma terrestris* [*R.A.M.*, ix, p. 155], from different parts of the United States [ibid., xxviii, p. 117]. Some of the isolates gave rise to pycnidia in culture media, and in all the experiments in which they were used, pycnidia were likewise produced either on the roots or cotyledons of plants grown in inoculated white silica sand. Only one isolate, from Louisiana, produced pycnidia on plants grown in soil. This is the first report of pycnidia on the host, but so far they have not been found in nature.

The pycnidia were uniformly setose, although the several isolates, especially those from Louisiana and California, varied considerably in the number and distribution of the setae and in other morphological characters of the pycnidium. Owing to the presence of setae on the pycnidium the species is transferred to *Pyrenochaete*, as *P. terrestris* (Hansen) comb. nov. with an emended description broadened sufficiently to include all the strains investigated. The immersed, later erumpent, ostiolate, papillate to slightly beaked, dark brown to black, subcarbonaceous pycnidia measure 120 to 450 μ in diameter. The light to dark brown, uni- to quinqueseptate setae, 8 to 120 μ in length, are generally grouped round the ostiole but may be scattered over the entire pycnidium. The continuous, hyaline, oblong to ovoid, biguttulate conidia, 3·7 to 5·8 by 1·8 to 2·4 μ, are sessile in the pycnidium, escaping as a gelatinous mass through ruptures or as a cirrus through the ostiole.

Isolates which freely produced pycnidia in culture lost this property when transfers were made with mycelium from old cultures, in which the fungus tended to mutate to the mycelial type. When sporulating cultures were transferred with mycelium from the advancing edge of the colony, or with spores, the sporulating faculty was retained. No production of sporulating mutants was observed in mycelial lines.

Kerling (L. C. P.). **Pythium debaryanum and related species in South Australia.**—*Trans. roy. Soc. S. Aust.*, lxxi, 2, pp. 253–258, 4 figs., 1947. [Received November, 1948.]

An investigation of pre-emergence rotting of peas at the Waite Institute showed that seedling infections by *Pythium* spp. [*R.A.M.*, xxvii, pp. 53, 169, 344] were important. The species concerned were investigated by the writer during a brief visit to Adelaide.

Nine strains, isolated by N. T. Flentje, were studied, six from pea seedlings grown on red-brown earth at the Waite Institute, two from potatoes affected by 'leak' [watery wound rot, usually due to *P. ultimum*: ibid., xxvi, p. 123], and one from a tomato seedling. It was found that diameters of oogonia and oospores were less variable than those of the sporangia (the production of zoospores was never observed), and counts of 100 to 300 oogonia revealed that they followed a normal frequency distribution. The sporangia, however, were much more variable in size and shape and only limits in size observed were recorded.

The isolates were all closely related fungi; four from pea and one from potato were identified as *P. debaryanum* [ibid., xxv, p. 316]. The average diameter of the oospores (17·4 to 19·9 μ) of the five strains falls within the limits of the range of means given in literature but there appeared to be significant differences between the five strains. A fifth isolate from peas was identified as *P. polymorphon*, although it differed slightly from the description of the species given by Middleton [ibid., xxii, p. 373], having oogonia averaging 16·2 μ in diameter (oospores 13·4) with the antheridia always monoclinous. This fungus is associated with peas for the first time. The second potato isolate was identified as *P. ultimum* as interpreted by Middleton and Drechsler [ibid., vi, p. 510], and the tomato isolate, the antheridia of which were diclinous and very variable in shape, as *P. vexans* [ibid., xxvi, p. 133]. The sixth isolate from peas exhibited antheridial types typical of both *P. ultimum* and *P. debaryanum*. In these studies the isolates were examined particularly in respect to antheridial characters, believed to be valuable criteria for identification, and were found to be rather more variable than the descriptions in Middleton's monograph might suggest. At least two types of antheridial structure occurred in one culture. The writer agrees with the view of van Luyk [ibid., xiv, p. 259] that the antheridial differences are not sufficient to warrant the segregation of *P. ultimum* from *P. debaryanum*.

Ekstrand (H.). **En för Sverige ny svampsjukdom på importerad Matlök.** [A fungal disease new to Sweden on imported eating Onions.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1948*, 4, pp. 63–64, 1 fig., 1948.

Part of a consignment of white onions imported into Sweden during the winter of 1947–8 was infected by *Aspergillus alliaceus* [*R.A.M.*, xix, p. 404], a new record for the country. The fungus had caused partial rotting of the scales or destroyed the entire onion, and its nearly black sclerotia occurred in profusion on the sunken portions. The yellow conidiophores were also present on some of the damaged tissues. The source of the diseased onions is unknown, but since the pathogen has hitherto been reported only from warm regions it is unlikely to become established in Sweden. A careful watch should be kept, however, for further cases of infection in imported onions to prevent any possibility of dissemination.

Castellani (E.). **Sull' azione antagonistica di due batteri verso 'Thielaviopsis basicola' (Berk. et Br.) Ferraris.** [On the antagonistic activity of two bacteria towards *Thielaviopsis basicola* (Berk. & Br.) Ferraris.]—Reprinted from *Ann. Accad. Agric. Torino*, xc, 1947–1948, 7 pp., [1948].

During studies on endive (*Cichorium endivia* [var.] *latifolium*) root rot (*Thielaviopsis basicola*) [*R.A.M.*, xxvii, p. 552] the author observed that the growth of the fungus in culture was retarded or even inhibited by bacterial colonies, two bacteria, referred to provisionally as A and B, being isolated with particular frequency. On plates of sweet potato broth plus 1 per cent. peptone agar inoculated with the fungus and incubated at 25° C. for 15 days both bacteria retarded the growth of the fungus, and when contact with either was made between the colonies fungal growth ceased. A fungus colony invaded by the bacterium showed distinctly atypical mycelium and there were few fructifications. Similar results were obtained when the fungus was grown in the presence of *Bacillus vulgatus* and the 'yellow antagonist' [cf. ibid., xx, p. 376].

The author concludes that the fact that *T. basicola* is more injurious to some hosts than others may, perhaps, be related to some extent to antagonistic action, exerted upon it by the microflora present in the rhizospheres of the different hosts.

Allington (W. B.) & Chamberlain (D. W.). **Brown stem rot of Soybean.**—*Phytopathology*, xxxviii, 10, pp. 793–802, 1 fig., 1948.

Much of the information in this account of brown stem rot of soy-beans in Illinois has been noticed from another source [*R.A.M.*, xxviii, p. 155]. The fungus responsible for the disease has been named *Cephalosporium gregatum* n.sp. On potato dextrose agar at 20° C. the mycelium develops in the form of a flat, dense, roughly orbicular, white to putty-coloured or grey mat, with radial folds and a variable, usually finely lobate margin, reaching a diameter of 2 to 2·4 cm. in 14 days. The hyaline, septate, branched hyphae measure 1·2 to 4·7 μ in diameter and frequently form aerial or decumbent fascicles in cultures over 10 days old. On soy-bean stem agar the conidiophores are usually only 4 to 15 μ in length but they may reach 25 μ. They are hyaline, continuous or septate, simple or branched, straight or clavate, and may be produced at any point on the fertile hypha, ordinarily in groups. The continuous, ovoid to elliptical, hyaline conidia 3·4 to 7·6 by 1·7 to 3·4 μ, are produced successively at the apex of the conidiophore, forming an irregular head, and are non-catenulate. The conidia produced inside the stems of the host are typically larger (6·8 to 9·4 by 3·4 to 4·3 μ) than those developing in pure culture. Germination is effected by a single germ-tube at one end, or occasionally by two germ-tubes, one at either extremity. Soy-bean stem agar was the best of the media tested for sporulation studies; on this substratum conidia appeared after five days at 20°. On soy-bean stem and potato dextrose agar the minimum,

optimum, and maximum growth temperatures for *C. gregatum* were below 8°, 22° to 24°, and above 30°, and the optimum and maximum for sporulation 15° to 20° and 28°, respectively. Conidial germination was observed after 24 hours in distilled water and in concentrated soy-bean stem juice at temperatures of 15° to 30° C., with a maximum percentage of 88 in the latter medium. The optimum range was 21° to 25°; at 15° and 30° the germination percentages were 0 to 2 and 0 to 9, respectively.

The new species differs from *C. acremonium* in cultural and morphological characters, as well as in its non-pathogenicity to maize. The conidia of *C. acremonium* are considerably narrower and shorter (2·5 to 6 by 1 to 1·8 μ) than those of *C. gregatum* and are produced in well-separated heads on erect conidiophores.

Air (but not soil) temperatures are of critical significance in the development of brown stem rot. Air temperatures below 21° were found to be essential for the rapid movement of the fungus up the stem and the development of the typical blighting and shrivelling of the leaves. Conidia were produced in the vascular system of naturally or artificially infected plants held at temperatures below 21°, having been detected in the exudate from cut stems through which water had been forced under considerable pressure. By the same method spore suspensions have been passed through sections of healthy stems, suggesting the possible importance of spore production and movement in the spread of internal infection.

Hildebrand (A. A.). **An occurrence of brown stem rot of Soybeans in Ontario.**—*Sci. Agric.*, xxviii, 6, pp. 261–263, 2 pl., 1948.

During September, 1947, a stand of soy-beans of the Lincoln variety in test plots at the Western Ontario Agricultural Experiment Station suffered from stem browning, leaf blight, interveinal chlorosis, lodging, and necrosis, characteristic of brown stem rot [see preceding abstract].

Isolations from infected tissue on to potato dextrose agar yielded almost invariably a slow-growing, putty-coloured mycelium with a semi-appressed, actinomycete-like growth habit. Within three days of inoculating the side-wall of a square opening cut out of agar and afterwards covered with a cover slip, slender, usually unbranched conidiophores with conidia developed. This fungus is indistinguishable from the species of *Cephalosporium* causing brown stem rot of soy-beans in Illinois [*C. gregatum*: loc. cit.].

The fungus exists in the soil and infection takes place either through the roots or at the base of the stem near ground-level. Since the incidence of the disease is considered to be dependent upon low air temperatures, it may not be expected to appear until the autumn. There is no evidence to suggest that the disease is seed-borne.

Conover (R. A.). **Studies of two viruses causing mosaic diseases in Soybean.**—*Phytopathology*, xxxviii, 9, pp. 724–735, 1 fig., 1948.

A full account is given of studies carried out in Illinois on two viruses causing soy-bean mosaic, namely, *Soja* virus 1 [soy-bean mosaic virus] and *Phaseolus* virus 2 [bean yellow mosaic virus: *R.A.M.*, iii, p. 626; xiii, p. 488; xxiv, p. 44, *et passim*]. Scarcely any work has been published on soy-bean mosaic in the United States since 1924, but a number of pathologists have observed its presence in all the major areas of production.

On the 'standard' Bansei variety the first symptom appearing six to 14 days after mechanical inoculation with the soy-bean mosaic virus is a transient, yellowish vein-clearing in the minor veins of the growing trifoliate leaves. The rugosity usually present on the third trifoliate leaf formed after inoculation increases in severity on successive leaves and eventually develops into dark green vesicles, either scattered or aligned on either side of the major leaf veins. Vein-clearing of

the mature leaves is common. The leaf margins frequently curve downwards at the sides and upwards at the tip. The leaves coarsen, becoming leathery to the touch, and somewhat brittle at maturity. The affected plants are stunted, and bear abnormally few pods, some of which may be laterally curved or twisted, with only scanty pubescence, and often infertile. With the exception of Ogden, the reactions of the oil-type varieties tested was much less severe than those of Bansei.

The initial manifestations of bean yellow mosaic virus are essentially identical with those already described, but more persistent. A pronounced yellow mottle is the typical feature of the successively developing leaves, the chlorotic areas being either scattered or forming indefinite bands along the sides of the major veins. Under certain conditions vivid yellow islets appear on the lamina. As the foliage matures, rusty, necrotic spots are formed in the chlorotic areas. The size of the affected plants was not appreciably reduced, while the pods were of healthy appearance and their numbers approximately normal. There were no marked differences in the response of vegetable- and oil-type soy-beans or of the several varieties tested to infection by bean yellow mosaic virus.

Air temperature exerted a considerable effect on the development of soy-bean mosaic virus symptoms, which were severe at 18·5° C. and largely masked at 29·5° [ibid., ii, p. 77]. The symptom expression of bean yellow mosaic virus was not materially modified by air temperature. The incubation period of both viruses varied widely with the prevailing temperature, soy-bean mosaic symptoms appearing in four days at 29·5°, in six at 24°, and in 14 at 18·5°, while the corresponding times for bean yellow mosaic were five, seven, and 12 days, respectively.

The soy-bean mosaic virus did not induce symptoms in any of the other legumes tested in host range studies, but it was recovered from the symptomless inoculated leaves of the Burpee's Stringless, Stringless Green Pod, and Stringless Green Refugee garden beans (*Phaseolus vulgaris*) after 23 to 27 days. Bean yellow mosaic virus, however, caused systemic mottling of white and yellow sweet clover (*Melilotus alba* and *M. officinalis*), crimson clover, Alaska and Telephone peas, and all garden bean varieties tested, and was recovered from these plants. The first symptom observed on certain bean varieties was a drooping of the leaflets at the pulvini; then small, halo-like spots appeared on the blades, expanded, and coalesced to form a prominent yellow mottling, which gradually became more distinct. At maturity the leaflets were cupped downwards and presented a somewhat glossy aspect. The plants were not markedly stunted and the pods were unaffected.

The thermal inactivation point of soy-bean mosaic virus was found to be between 64° and 66° and its longevity *in vitro* extended over four days. The thermal inactivation point of bean yellow mosaic virus lay between 54° and 56° and it withstood three to four days' ageing *in vitro*. In neither case could the dilution end points be reliably established.

The transmission of soy-bean mosaic virus through the seed has been demonstrated [ibid., iii, p. 626; xiii, p. 489; xx, p. 444], but yellow bean mosaic virus was not transmitted in the author's experiments in 6,685 seedlings grown from the seed of inoculated and naturally infected soy-beans, or in 107 from the seed of inoculated garden beans. Soy-bean mosaic virus was conveyed from diseased plants to healthy seedlings by the pea and peach aphids (*Macrosiphum pisi* and *Myzus persicae*). Bean yellow mosaic virus was transmitted from diseased garden bean plants to healthy seedlings in only one out of nine tests with *Macrosiphum pisi*.

KEENER (P. D.). **Virus diseases of Melons.**—*Bull. Ariz. agric. Exp. Sta.* 217, pp. 10–13, 3 figs., 1948.

One of the most common virus diseases of melons in Arizona is mosaic (cucumber mosaic virus) [*R.A.M.*, xxv, p. 92], which attacked numerous melon plantings in the Salt River and Yuma Valleys during 1948. It is believed that at least two or

three strains of the virus occur in the State; one, causing veinbanding [ibid., xxvii, p. 271], was observed in 1947 in a cantaloupe planting north of Tolleson. Other locally occurring melon viruses include [beet] curly top [ibid., xxvi, p. 530] and probably yellow net virus [ibid., xxviii, p. 105], symptoms resembling which have been observed on cantaloupes and watermelons in Deer Valley and the Buckeye area.

Brown (J. G.) & Emmons (Maryhelen). **A bacterial disease of Melons in southern Arizona.**—*Bull. Ariz. agric. Exp. Sta.* 217, pp. 3–9, 7 figs., 1948.

Cantaloupes in the Salt River Valley, southern Arizona, suffered serious losses from a bacterial blight, which assumed almost epidemic proportions. It occurred also on a few cantaloupe vines in Pima County. Honeydew melons and water melons were also affected, but to a lesser degree.

Early in the season of 1948, the first cantaloupe leaves showed small, brownish, water-soaked spots either close to, or on the margin, which rapidly increased in size, often becoming wedge-shaped; finally the whole or part of the leaf was dry and brittle. The petioles had brown, depressed areas which often became water-soaked, and ultimately dried. The infection progressed, affecting the younger leaves on the runners, and also the older leaves, buds, and flowers. Honeydew melons and watermelons showed the same type of floral infection. The blight on young fruits resulted apparently from previous floral infections; they turned yellow, then light brown, with darker, shrunken, and shrivelled areas. Fields that appeared healthy from a distance often contained small, blighted fruits and some infected leaves.

Isolations from infected leaves, petioles, flowers, fruits, and the surface of the cantaloupe seeds from which the blighted crop was grown, yielded a bacterium which agreed closely with *Erwinia aroideae* [*R.A.M.*, xvii, p. 723]. Inoculations with the organism into various parts of cantaloupe plants induced symptoms identical with those observed in the field. It also attacked honeydew melon and cucumber fruits. It is suggested that the infection started from the contaminated seed and was spread by the abnormal numbers of insects present in the fields.

Cantaloupes and other melons should not follow crops of any hosts susceptible to *E. aroideae*. Other control measures include seed treatment with a solution of mercuric chloride or semesan, removal of infected plant debris, and, particularly, deep ploughing, in preference to disking of melon fields.

Branas (J.). **Recherches sur la dégénérescence infectieuse de la Vigne.** [Studies on infectious degeneration of the Vine.]—*Bull. Off. int. Vin.*, xxi, 205, pp. 7–12, 6 figs., 1948.

An account is given of grafting experiments at the School of Agriculture, Montpellier (France), with clones of the Rupestris du Lot vine variety (*a*) healthy and (*b*) suffering from infectious degeneration [court-noue: *R.A.M.*, xxviii, p. 2 and above, p. 157]. In one of the tests the mosaic symptoms of the disease were separated from those of foliar malformation, from which it is argued that a virus complex is involved in its etiology. The separation appears to have arisen in the course of grafting diseased scions on to healthy stocks, contact between which was maintained only for 66 days. The mosaic symptoms seem to be more evanescent than those of infectious degeneration.

Bawden (F. C.) & Roberts (F[lorence] M.). **The influence of light intensity on the susceptibility of plants to certain viruses.**—*Ann. appl. Biol.*, xxxiv, 2, pp. 286–296, 1 pl., 1948.

In experiments carried out at Rothamsted between the beginning of May and

the end of September, the susceptibility of White Burley tobacco plants to infection by the Rothamsted culture of tobacco necrosis virus [see next abstract], of *Nicotiana glutinosa* and Kondine Red tomato to tomato bushy stunt virus, *N. glutinosa* and tobacco to tobacco mosaic virus, and tobacco and tomato to tomato aucuba mosaic [strain of tobacco mosaic] virus, was increased by reducing to one-third the light intensity under which the plants were grown by covering them with white muslin cages. In the case of the first two viruses the average number of local lesions per leaf was increased by more than ten times and by more than five times with the second two. The virus content of sap from leaves of shaded plants inoculated with the tobacco necrosis virus was increased by as much as twenty times. Purification was greatly facilitated as the solid content of sap was also reduced by about one-half. Crystalline preparations of the virus were readily made from shaded plants but not from unshaded controls. Reducing the light intensity also increased the virus content of systemically infected leaves, the greatest increase of up to ten times being obtained with tomato bushy stunt virus. Significant increases also occurred with tobacco mosaic and aucuba mosaic viruses.

One of the most noticeable effects of shading was to delay the onset of symptoms of maturity which showed in the controls as coarser-textured, thicker, and more chlorotic leaves.

The increased susceptibility induced by reducing light intensity may be partly mechanical by increasing ease of virus entry into inoculated leaves, but may also be partly an intracellular phenomenon because of the reduced formation of cell contents that interfere with the ready establishment of virus particles in conditions necessary for their multiplication. According to this view some products of photosynthesis would act in a manner analogous to antibodies, so that the more of them a cell contained the more virus would need to be introduced before their neutralizing effects were overcome and active multiplication could begin.

Bawden (F. C.) & Roberts (F[lorence] M.). **Photosynthesis and predisposition of plants to infection with certain viruses.**—*Ann. appl. Biol.*, xxxv, 3, pp. 418–428, 1948.

Experiments were made between April and September, 1947, at Rothamsted to determine the effects on susceptibility to infection with certain viruses of subjecting plants to various periods of darkness or reduced illumination before and after inoculation. The viruses and hosts used were the Rothamsted culture of tobacco necrosis virus [*R.A.M.*, xxvii, p. 22] in French bean (*Phaseolus vulgaris*) var. Prince and tobacco var. White Burley; tomato aucuba mosaic virus (a strain of tobacco mosaic virus) in tobacco; and tobacco mosaic and tomato bushy stunt viruses in *Nicotiana glutinosa*. All the virus-host combinations used react with necrotic local lesions only, and susceptibility was measured by local lesion counts.

Susceptibility was consistently increased by pre-inoculation treatments of host plants, whereas post-inoculation treatments had relatively little effect, but most often decreased susceptibility. Short periods in the dark produced similar responses to longer periods in shade, but the different species of plant varied in their responses to and tolerance of darkness. The maximum number of lesions was usually obtained with bean plants kept for only 24 hours in the dark before inoculation, but with tobacco plants susceptibility increased with increasing time in darkness up to five days.

It is suggested that the successful establishment of infection occurs in two stages, the first of which is affected by the accumulation of photosynthetic products. Whether these products confer resistance by increasing cell turgor or by reacting specifically with virus particles is unknown, but sap from plants in the light possesses no greater virus-inhibiting power than sap from plants kept in darkness.